

MOSFETs Silicon Carbide N-Channel MOS

TW083U65C

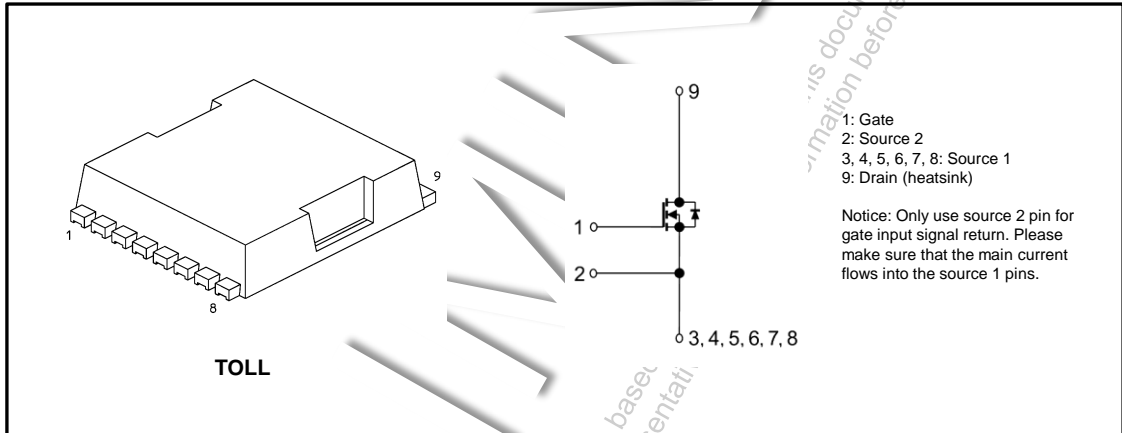
1. Applications

- Switching Voltage Regulators

2. Features

- (1) Chip design of 3rd generation (Built-in SiC schottky barrier diode)
- (2) Low diode forward voltage: $V_{DSF} = -1.35\text{ V}$ (typ.)
- (3) High voltage: $V_{DSS} = 650\text{ V}$
- (4) Low drain-source on-resistance: $R_{DS(ON)} = 83\text{ m}\Omega$ (typ.)
- (5) Less susceptible to malfunction due to high threshold voltage: $V_{th} = 3.0\text{ to }5.0\text{ V}$ ($V_{DS} = 10\text{ V}$, $I_D = 0.6\text{ mA}$)
- (6) Recommended gate - source drive voltage: $V_{GS_on} = 18\text{ V}$, $V_{GS_off} = 0\text{ V}$
- (7) Enhancement mode.

3. Packaging and Internal Circuit



4. Absolute Maximum Ratings (Note) ($T_a = 25\text{ }^\circ\text{C}$ unless otherwise specified)

Characteristics	Symbol	Rating	Unit
Drain-source voltage	V_{DS}	650	V
Gate-source voltage (DC)	V_{GS}	+25/-10	
Drain current (DC) ($T_c = 25\text{ }^\circ\text{C}$)	I_D	30	A
Drain current (DC) ($T_c = 100\text{ }^\circ\text{C}$)	I_D	21	
Drain current (pulsed) ($T_c = 25\text{ }^\circ\text{C}$)	I_{DP}	66	
Drain current (pulsed) ($T_c = 100\text{ }^\circ\text{C}$)	I_{DP}	52	
Power dissipation ($T_c = 25\text{ }^\circ\text{C}$)	P_D	111	W
Channel temperature	T_{ch}	175	$^\circ\text{C}$
Storage temperature	T_{stg}	-55 to 175	

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	$R_{th(ch-c)}$	1.350	$^\circ\text{C/W}$

Note 1: Ensure that the channel temperature does not exceed $175\text{ }^\circ\text{C}$.

Note: This transistor is sensitive to electrostatic discharge and should be handled with care. It should be used for switching applications.

6. Electrical Characteristics

6.1. Static Characteristics ($T_a = 25\text{ }^\circ\text{C}$ unless otherwise specified)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current	I_{GSS}	$V_{GS} = +25/-10\text{ V}, V_{DS} = 0\text{ V}$	—	—	± 0.1	μA
Drain cut-off current	I_{DSS}	$V_{DS} = 650\text{ V}, V_{GS} = 0\text{ V}$	—	3	37	
		$T_a = 150\text{ }^\circ\text{C}$ $V_{DS} = 650\text{ V}, V_{GS} = 0\text{ V}$	—	14	—	
Drain-source break down voltage	$V_{(BR)DSS}$	$I_D = 4\text{ mA}, V_{GS} = 0\text{ V}$	650	—	—	V
Gate threshold voltage (Note 2)	V_{th}	$V_{DS} = 10\text{ V}, I_D = 0.6\text{ mA}$	3.0	—	5.0	
Drain-source on-resistance	$R_{DS(ON)}$	$V_{GS} = 18\text{ V}, I_D = 15\text{ A}$	—	83	118	$\text{m}\Omega$
		$T_a = 150\text{ }^\circ\text{C}, V_{GS} = 18\text{ V}, I_D = 15\text{ A}$	—	89	—	

Note 2 : Please be sure to apply I_{GSS} ($V_{GS} = 25\text{ V}$) before the V_{th} test.

PRELIMINARY

Do not design your products or systems based on the information on this document.
Please contact your Toshiba sales representative for updated information before designing your products.

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

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit	
Input capacitance	C _{iss}	V _{DS} = 400 V, V _{GS} = 0 V, f = 100 kHz	—	873	—	pF	
Reverse transfer capacitance	C _{rss}		—	3.4	—		
Output capacitance	C _{oss}		—	110	—		
Effective output capacitance (energy related)	Co(er)		—	125	—		
Effective output capacitance (time related)	Co(tr)		—	180	—		
Output charge	Q _{oss}		—	72	—		nC
Coss stored energy	E _{oss}		—	10	—		μJ
Gate resistance	r _g	V _{DS} = OPEN, f = 1MHz	—	4.4	—	Ω	
Turn-on delay time	t _{d(on)}	See Fig. 6.2.1	—	21	—	ns	
Turn-on delay time (rise time)	t _r		—	14	—		
Turn-off delay time	t _{d(off)}		—	28	—		
Switching time (fall time)	t _f		—	14	—		
Turn-on switching loss	E _{on}		—	98	—		μJ
Turn-off switching loss	E _{off}		—	38	—		

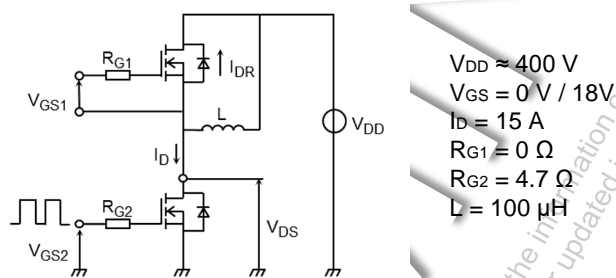


Fig. 6.2.1 Switching Time Test Circuit

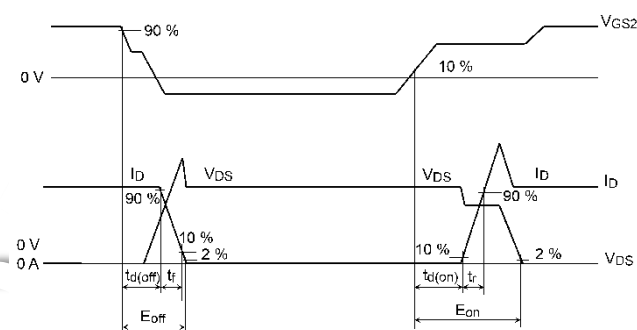


Fig. 6.2.2 Timing Diagrams

6.3. Gate Charge Characteristics ($T_a = 25\text{ }^\circ\text{C}$ unless otherwise specified)

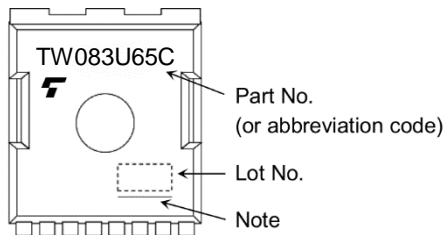
Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Total gate charge (gate-source plus gate-drain)	Q_g	$V_{DD} = 400\text{ V}, V_{GS} = 18\text{ V}, I_D = 15\text{ A}$	—	28	—	nC
Gate-source charge 1	Q_{gs1}		—	14	—	
Gate-drain charge	Q_{gd}		—	3.9	—	

6.4. Source · Drain Characteristics ($T_a = 25\text{ }^\circ\text{C}$ unless otherwise specified)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Reverse drain current (DC) (Note 3)	I_{DR}	$T_c = 25\text{ }^\circ\text{C}, V_{GS} = -5\text{ V}$	—	—	26	A
Reverse drain current (pulse) (Note 3)		$T_c = 100\text{ }^\circ\text{C}, V_{GS} = -5\text{ V}$	—	—	17	
		$T_c = 25\text{ }^\circ\text{C}, V_{GS} = 18\text{ V}$	—	—	30	
		$T_c = 100\text{ }^\circ\text{C}, V_{GS} = 18\text{ V}$	—	—	21	
	I_{DRP}	$T_c = 25\text{ }^\circ\text{C}, V_{GS} = -5\text{ V}$	—	—	66	
$T_c = 100\text{ }^\circ\text{C}, V_{GS} = -5\text{ V}$		—	—	29		
$T_c = 25\text{ }^\circ\text{C}, V_{GS} = 18\text{ V}$		—	—	66		
$T_c = 100\text{ }^\circ\text{C}, V_{GS} = 18\text{ V}$		—	—	52		
Diode forward voltage	V_{DSF}	$I_{DR} = 8\text{ A}, V_{GS} = -5\text{ V}$	—	-1.35	-1.80	V
		$T_a = 150\text{ }^\circ\text{C}, I_{DR} = 8\text{ A}, V_{GS} = -5\text{ V}$	—	-1.57	—	
Reverse recovery time	t_{rr}	$I_{DR} = 10\text{ A}, V_{GS} = 0\text{ V}, V_{DD} = 400\text{ V}, -di_{DR}/dt = 1000\text{ A}/\mu\text{s}$	—	45	—	ns
Reverse recovery charge	Q_{rr}		—	189	—	nC
Peak reverse recovery current	I_{rr}		—	8.4	—	A

Note 3 : Ensure that the channel temperature does not exceed $175\text{ }^\circ\text{C}$.

7. Marking



Note: A line under a Lot No. identifies the indication of product Labels.

Not underlined: [[Pb]]/INCLUDES > MCV

Underlined: [[G]]/RoHS COMPATIBLE or [[G]]/RoHS [[Pb]]

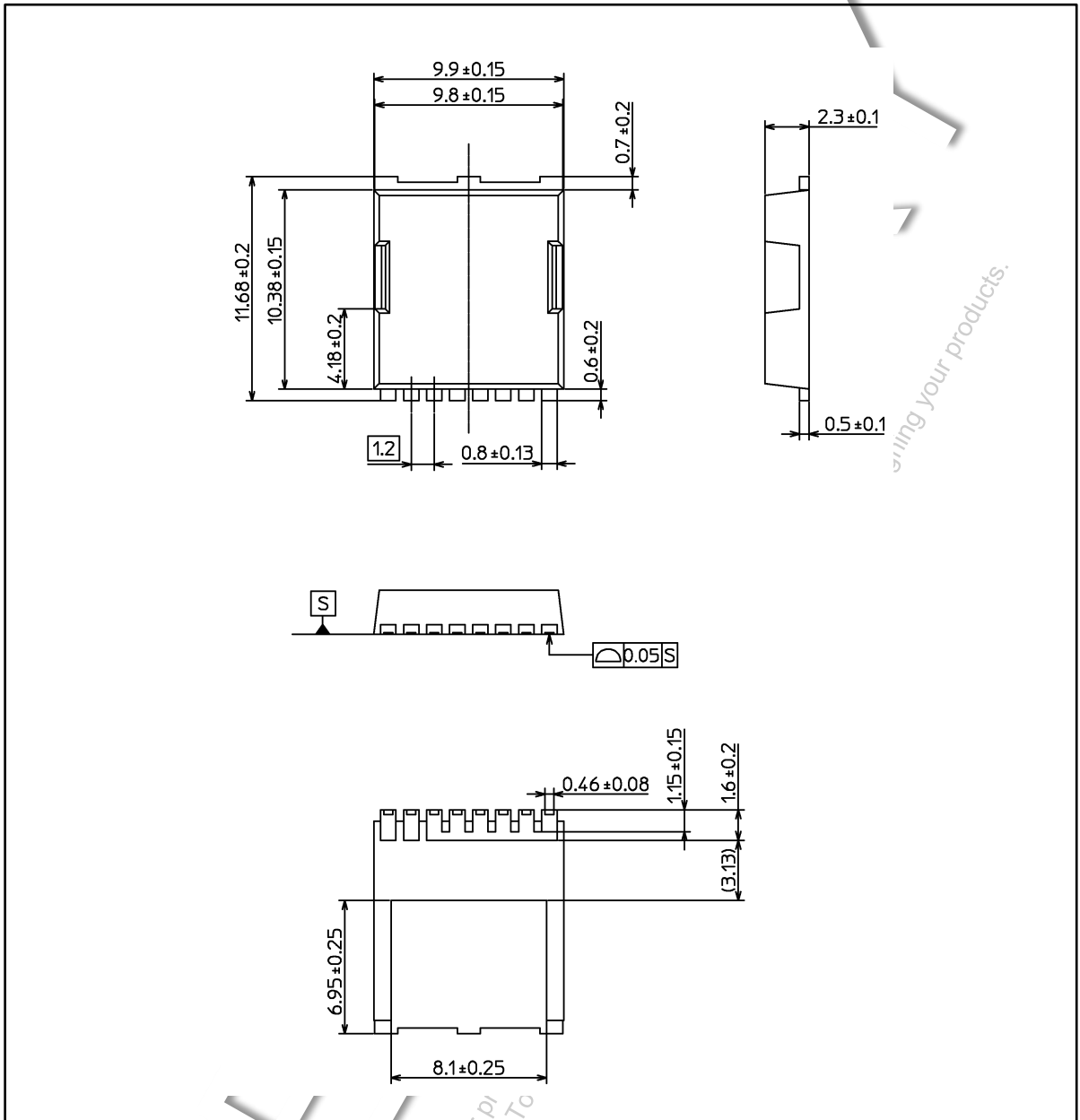
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Package Dimensions

Unit: mm



Weight: 0.75 g(typ.)

Package Name(s)
Toshiba: 2-10AF1A
Nickname: TOLL

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