

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

## XPQ1R00AQB

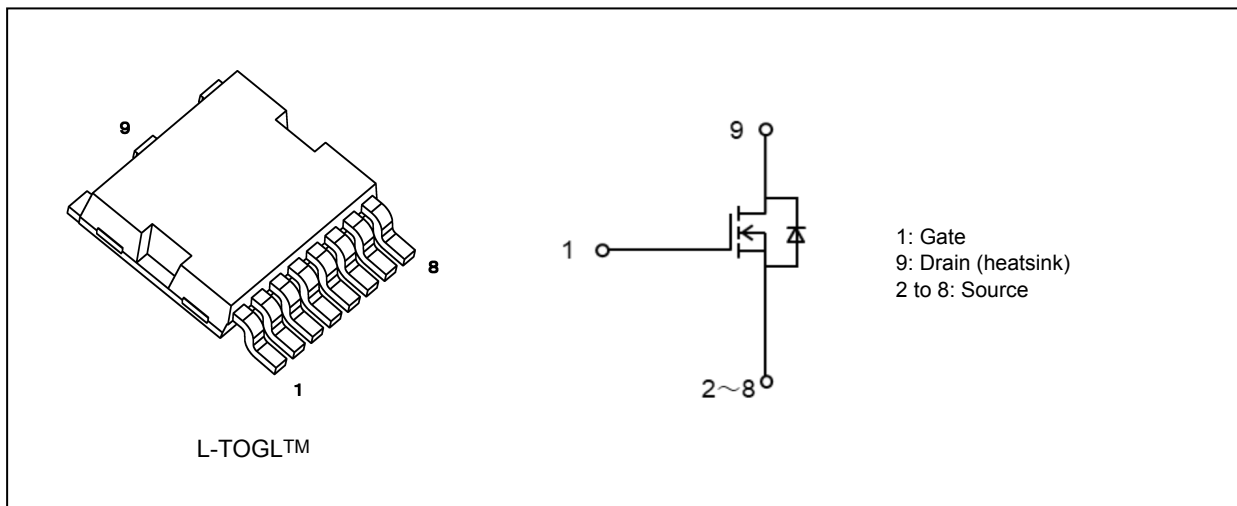
### 1. Applications

- Automotive
- Switching Voltage Regulators
- Motor Drivers
- DC-DC Converters

### 2. Features

- (1) AEC-Q101 qualified
- (2) Low drain-source on-resistance:  $R_{DS(ON)} = 0.84 \text{ m}\Omega$  (typ.) ( $V_{GS} = 10 \text{ V}$ )
- (3) Low leakage current:  $I_{DSS} = 10 \text{ }\mu\text{A}$  (max) ( $V_{DS} = 100 \text{ V}$ )
- (4) Enhancement mode:  $V_{th} = 2.5 \text{ to } 3.5 \text{ V}$  ( $V_{DS} = 10 \text{ V}$ ,  $I_D = 1.5 \text{ mA}$ )

### 3. Packaging and Internal Circuit (Note)



Note: L-TOGL™ is a trademark of Toshiba Electronic Devices & Storage Corporation.

Start of commercial production

2023-05

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

Characteristics	Symbol	Rating	Unit
Drain-source voltage	$V_{DSS}$	100	V
Gate-source voltage	$V_{GSS}$	$\pm 20$	
Drain current (DC) (Note 1)	$I_D$	300	A
Drain current (pulsed) (Note 1)	$I_{DP}$	900	
Power dissipation ( $T_c = 25\text{ °C}$ )	$P_D$	750	W
Single-pulse avalanche energy (Note 2)	$E_{AS}$	725	mJ
Single-pulse avalanche current	$I_{AS}$	150	A
Channel temperature (Note 3)	$T_{ch}$	175	$^{\circ}\text{C}$
Storage temperature (Note 3)	$T_{stg}$	-55 to 175	$^{\circ}\text{C}$

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).

Note: In this product, radiation resistance and cosmic ray resistance are not designed, and these natural environmental factors may affect reliability.

In addition, radiation from the constituent materials of the product also becomes a natural environmental factor which may affect reliability.

### 5. Thermal Characteristics

Characteristics	Symbol	Max	Unit
Channel-to-case thermal impedance ( $T_c = 25\text{ °C}$ )	$Z_{th(ch-c)}$	0.2	$^{\circ}\text{C}/\text{W}$

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

Note 2:  $V_{DD} = 80\text{ V}$ ,  $T_{ch} = 25\text{ °C}$  (initial),  $L = 24.8\text{ }\mu\text{H}$ ,  $R_G = 25\text{ }\Omega$ ,  $I_{AS} = 150\text{ A}$

Note 3: The definitions of the absolute maximum channel and storage temperatures are based on AEC-Q101.

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

### 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	$I_{GSS}$	$V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$	—	—	$\pm 1$	$\mu\text{A}$
Drain cut-off current	$I_{DSS}$	$V_{DS} = 100\text{ V}, V_{GS} = 0\text{ V}$	—	—	10	
Drain-source breakdown voltage	$V_{(BR)DSS}$	$I_D = 10\text{ mA}, V_{GS} = 0\text{ V}$	100	—	—	V
	$V_{(BR)DSX}$	$I_D = 10\text{ mA}, V_{GS} = -20\text{ V}$	80	—	—	
Gate threshold voltage (Note 4)	$V_{th}$	$V_{DS} = 10\text{ V}, I_D = 1.5\text{ mA}$	2.5	—	3.5	
Drain-source on-resistance	$R_{DS(ON)}$	$V_{GS} = 6\text{ V}, I_D = 150\text{ A}$	—	1.1	1.93	$\text{m}\Omega$
		$V_{GS} = 10\text{ V}, I_D = 150\text{ A}$	—	0.84	1.03	

#### 6.2. Dynamic Characteristics ( $T_a = 25\text{ }^\circ\text{C}$ unless otherwise specified)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Input capacitance	$C_{iss}$	$V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 300\text{ KHz}$	—	16500	21450	$\text{pF}$
Reverse transfer capacitance	$C_{rSS}$		—	1000	1700	
Output capacitance	$C_{oss}$		—	6800	—	
Gate resistance	$r_g$		—	2.3	4.6	$\Omega$
Switching time (rise time)	$t_r$	See Fig. 6.2.1	—	85	—	ns
Switching time (turn-on time)	$t_{on}$		—	160	—	
Switching time (fall time)	$t_f$		—	85	—	
Switching time (turn-off time)	$t_{off}$		—	290	—	

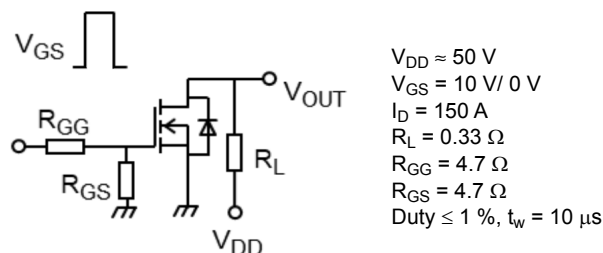


Fig. 6.2.1 Switching Time Test Circuit

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

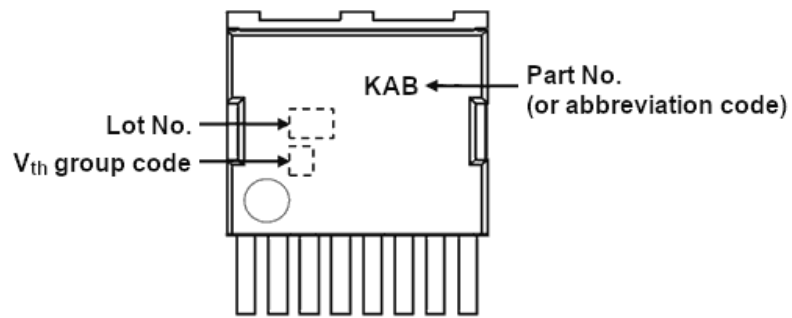
Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Total gate charge (gate-source plus gate-drain)	$Q_g$	$V_{DD} \approx 80\text{ V}, V_{GS} = 10\text{ V}, I_D = 300\text{ A}$	—	269	—	nC
Gate-source charge 1	$Q_{gs1}$		—	80	—	
Gate-drain charge	$Q_{gd}$		—	73	—	

#### 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 5)	$I_{DR}$	—	—	—	300	A
Reverse drain current (pulsed) (Note 5)	$I_{DRP}$	—	—	—	900	
Diode forward voltage	$V_{DSF}$	$I_{DR} = 300\text{ A}, V_{GS} = 0\text{ V}$	—	—	-1.2	V
Reverse recovery time	$t_{rr}$	$I_{DR} = 300\text{ A}, V_{GS} = 0\text{ V}$ $-di_{DR}/dt = 100\text{ A}/\mu\text{s}$	—	122	—	ns
Reverse recovery charge	$Q_{rr}$		—	369	—	nC

Note 5: Ensure that the channel temperature does not exceed  $175\text{ }^\circ\text{C}$ .

## 7. Marking



**Fig. 7.1 Marking**

Note 4: If requested, V<sub>th</sub> grouping is possible for each reel. (V<sub>th</sub> width is 0.4 V)

However, we do not accept specifications in specific groups.

If there is no request, the group-free reel will be applied. (V<sub>th</sub> width is 1.0 V, no V<sub>th</sub> group code is printed on marking)

## 8. Characteristics Curves (Note)

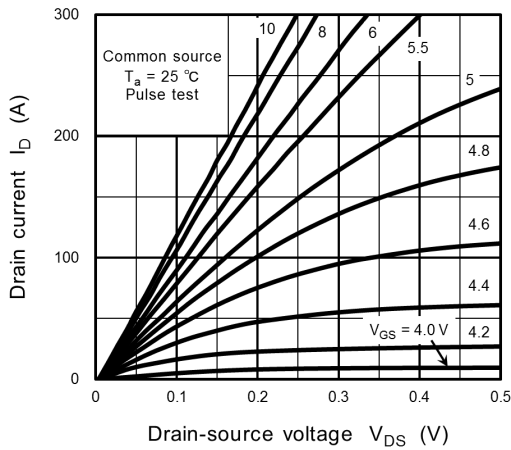


Fig. 8.1  $I_D - V_{DS}$

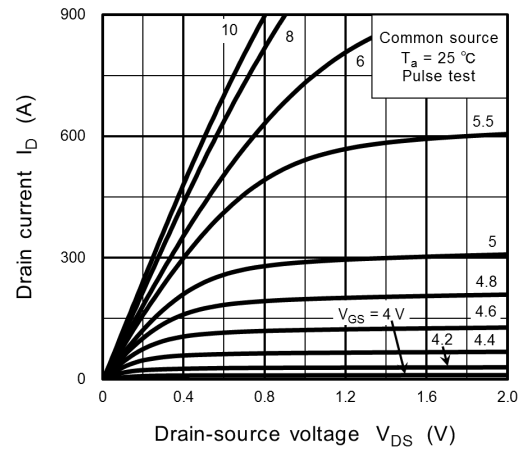


Fig. 8.2  $I_D - V_{DS}$

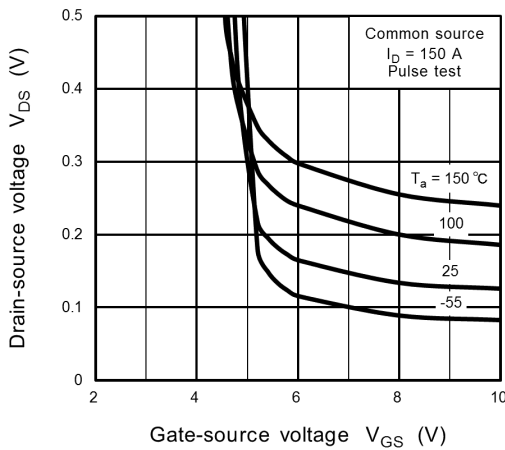


Fig. 8.3  $V_{DS} - V_{GS}$

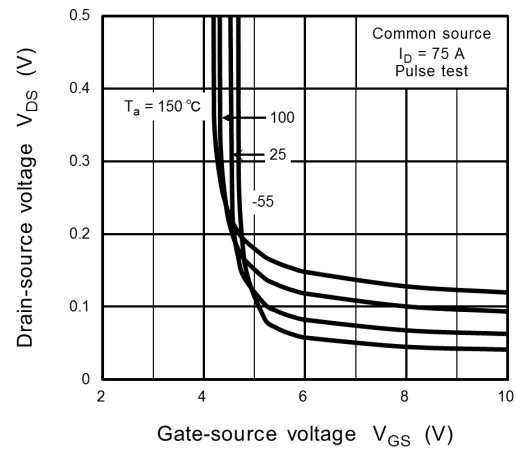


Fig. 8.4  $V_{DS} - V_{GS}$

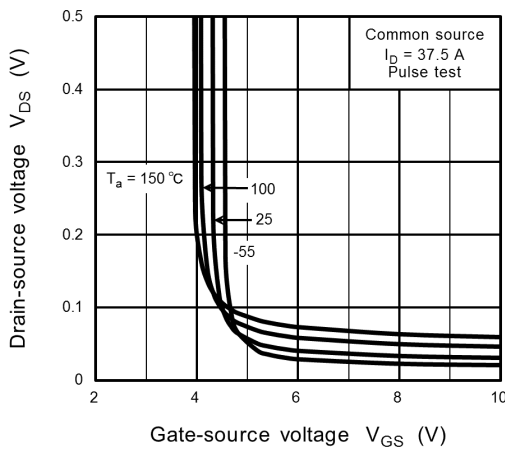


Fig. 8.5  $V_{DS} - V_{GS}$

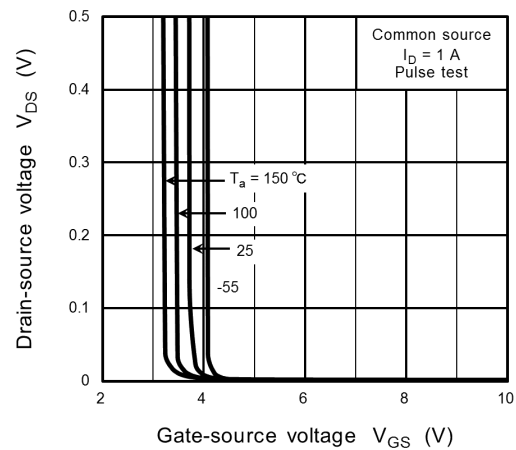
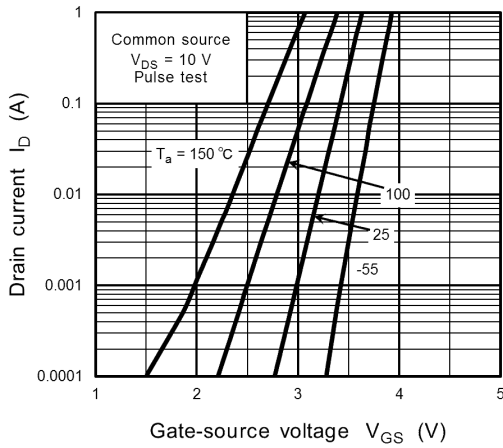
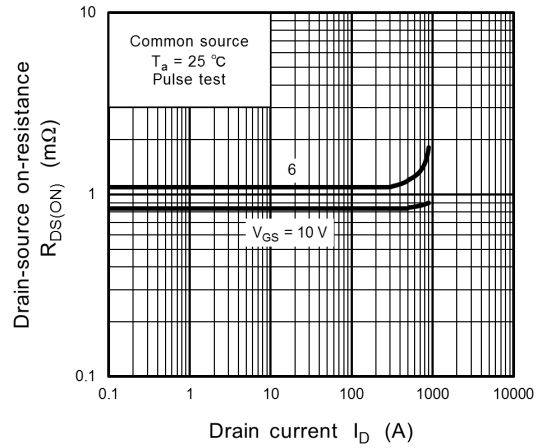


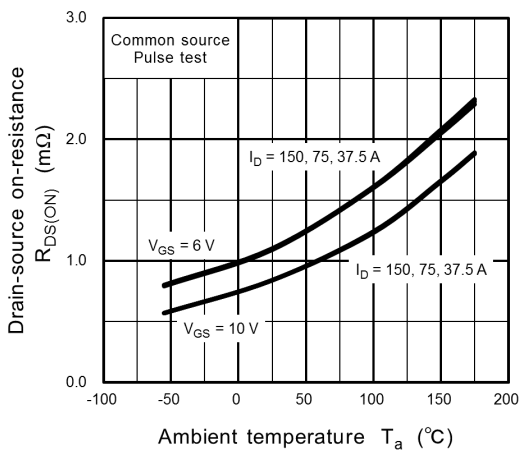
Fig. 8.6  $V_{DS} - V_{GS}$



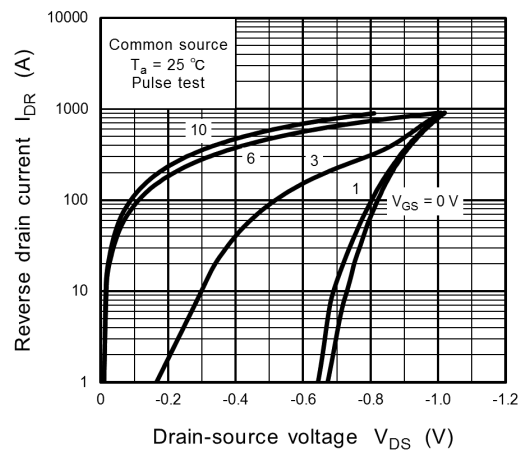
**Fig. 8.7  $I_D - V_{GS}$**



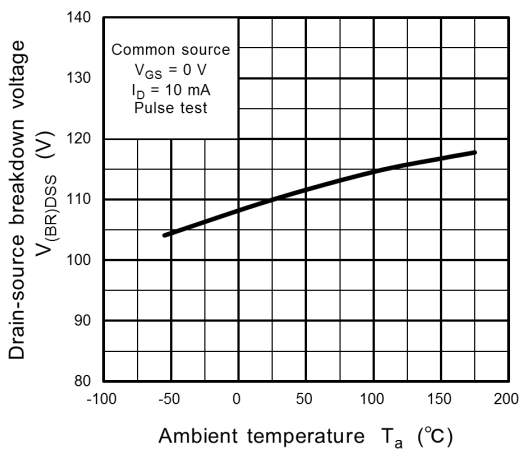
**Fig. 8.8  $R_{DS(ON)} - I_D$**



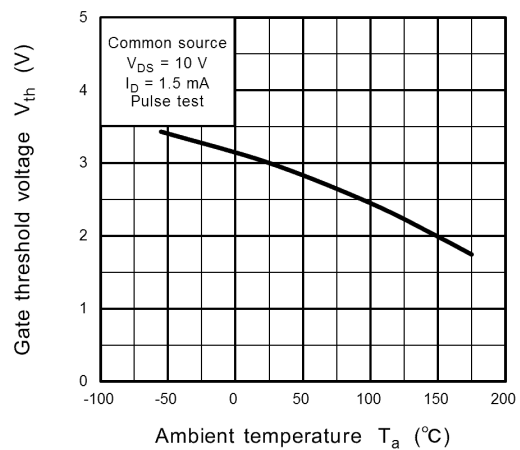
**Fig. 8.9  $R_{DS(ON)} - T_a$**



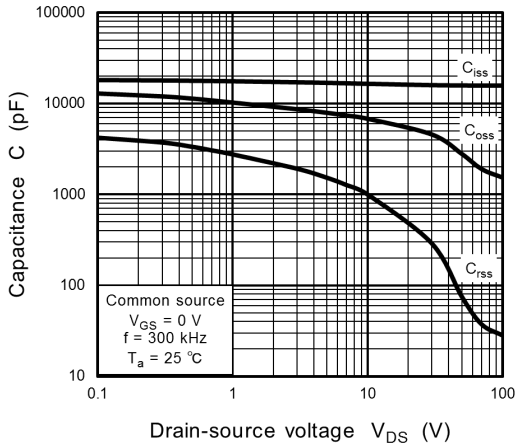
**Fig. 8.10  $I_{DR} - V_{DS}$**



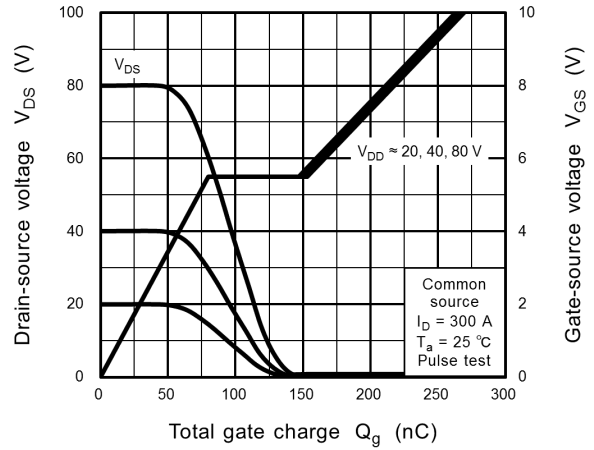
**Fig. 8.11  $V_{(BR)DSS} - T_a$**



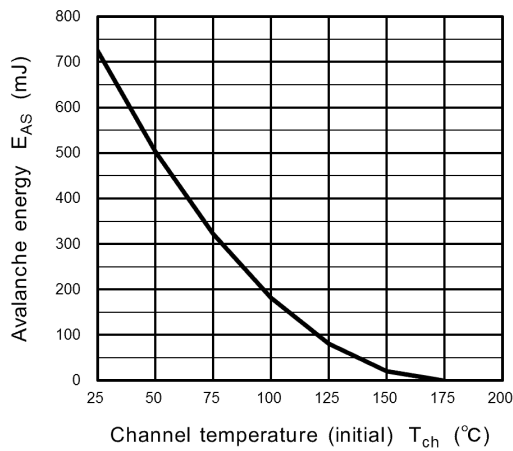
**Fig. 8.12  $V_{th} - T_a$**



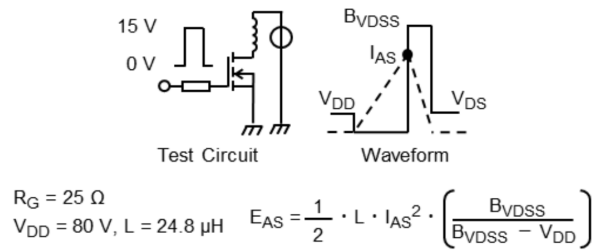
**Fig. 8.13 Capacitance -  $V_{DS}$**



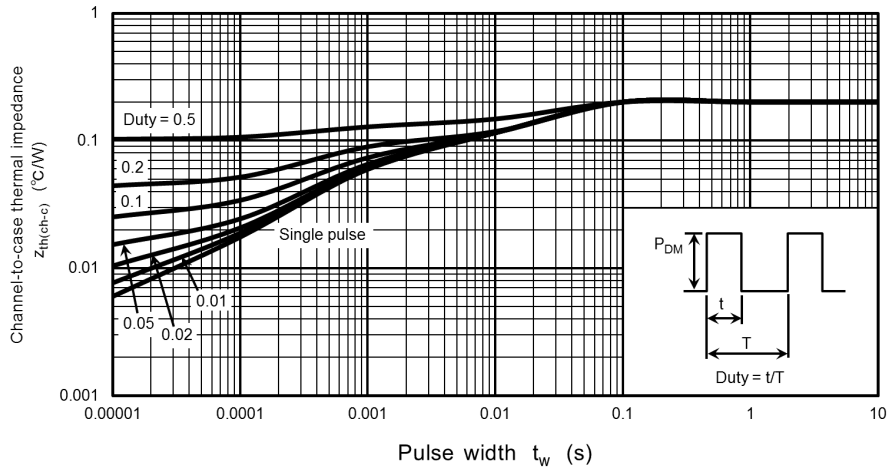
**Fig. 8.14 Dynamic Input/Output Characteristics**



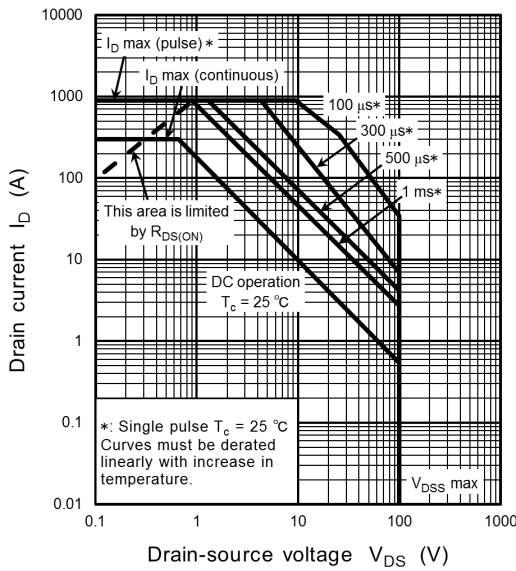
**Fig. 8.15  $E_{AS}$  -  $T_{ch}$ (Guaranteed Maximum)**



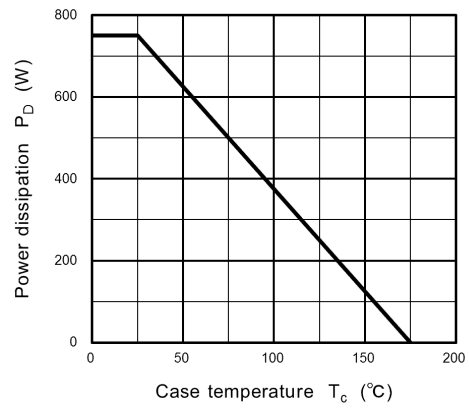
**Fig. 8.16 Test Circuit/Waveform**



**Fig. 8.17  $Z_{th(ch-c)} - t_w$**   
(Guaranteed Maximum)



**Fig. 8.18 Safe Operating Area**  
(Guaranteed Maximum)



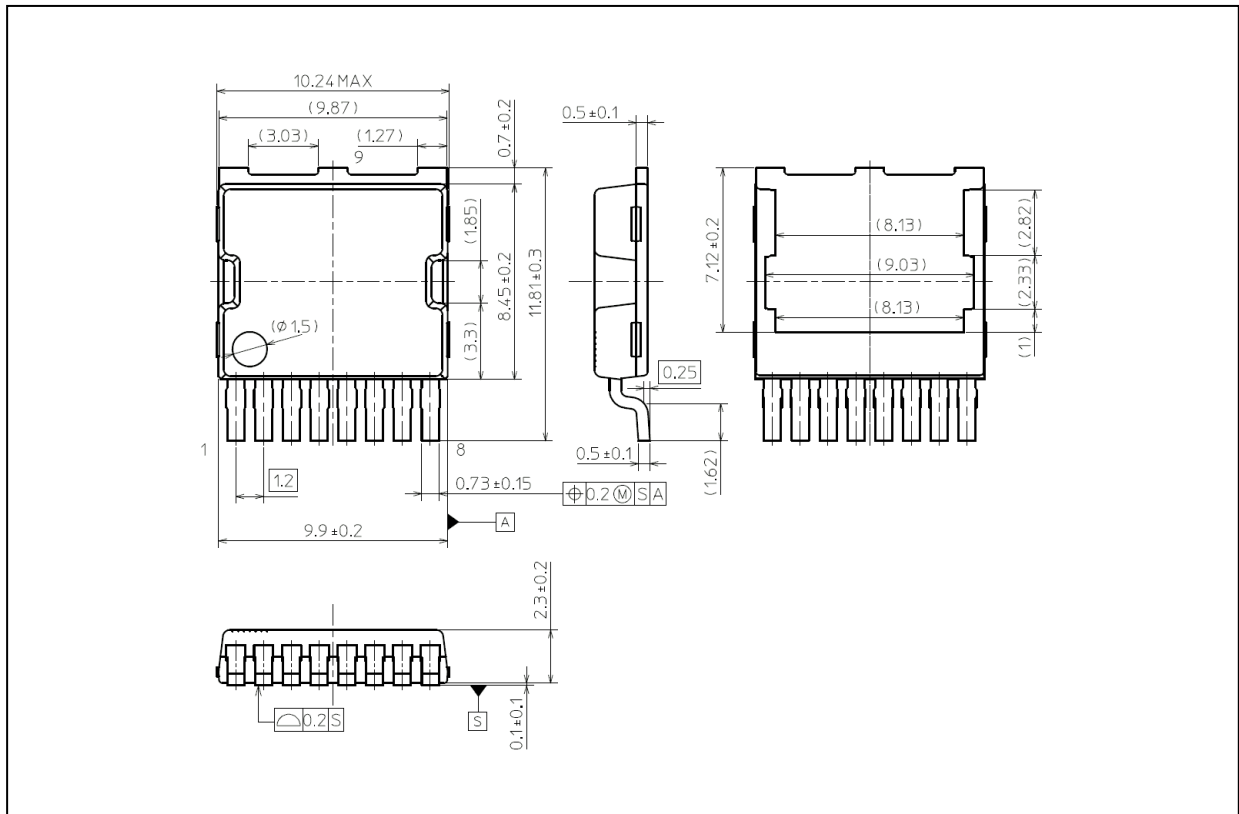
**Fig. 8.19  $P_D - T_c$**   
(Guaranteed Maximum)

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



## Package Dimensions

Unit: mm



Weight: 0.803 g (typ.)

Package Name(s)
TOSHIBA: 2-10AG1A
Nickname: L-TOGL™

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