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

TPH3R70APL

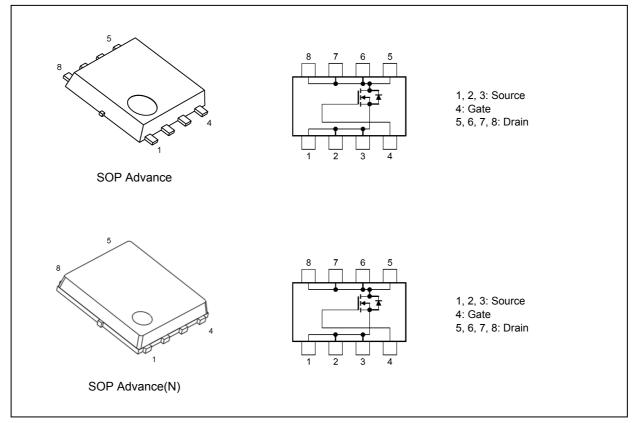
1. Applications

- High-Efficiency DC-DC Converters
- Switching Voltage Regulators
- Motor Drivers

2. Features

- (1) High-speed switching
- (2) Small gate charge: $Q_{SW} = 21 \text{ nC}$ (typ.)
- (3) Small output charge: $Q_{oss} = 74 \text{ nC}$ (typ.)
- (4) Low drain-source on-resistance: $R_{DS(ON)} = 3.1 \text{ m}\Omega$ (typ.) (V_{GS} = 10 V)
- (5) Low leakage current: I_{DSS} = 10 μ A (max) (V_{DS} = 100 V)
- (6) Enhancement mode: V_{th} = 1.5 to 2.5 V (V_{DS} = 10 V, I_D = 1 mA)

3. Packaging and Internal Circuit



The package can be selected according to your preference. For details, please contact your TOSHIBA sales representative.

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

Characterist	ics		Symbol	Rating	Unit
Drain-source voltage			V _{DSS}	100	V
Gate-source voltage			V _{GSS}	±20	
Drain current (DC)	(T _c = 25 °C)	(Note 1)	Ι _D	90	A
Drain current (DC)	(Silicon limit)	(Note 1), (Note 2)	Ι _D	150	
Drain current (pulsed)	(t = 100 μs)	(Note 1)	I _{DP}	500	
Power dissipation	(T _c = 25 °C)		PD	170	W
Power dissipation		(Note 3)	PD	3	
Power dissipation		(Note 4)	PD	0.96	
Single-pulse avalanche energy		(Note 5)	E _{AS}	150	mJ
Single-pulse avalanche current		(Note 5)	I _{AS}	90	A
Channel temperature			T _{ch}	175	°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	6		Symbol	Max	Unit
Channel-to-case thermal resistance	(T _c = 25 °C)		R _{th(ch-c)}	0.88	°C/W
Channel-to-ambient thermal resistance	(T _a = 25 °C)	(Note 3)	R _{th(ch-a)}	50	
Channel-to-ambient thermal resistance	(T _a = 25 °C)	(Note 4)	R _{th(ch-a)}	156	

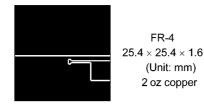
Note 1: Ensure that the channel temperature does not exceed 175 °C.

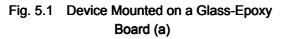
Note 2: Limited by silicon chip capability.

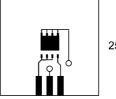
Note 3: Device mounted on a glass-epoxy board (a), Figure 5.1

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

Note 5: V_DD = 60 V, T_ch = 25 °C (initial), L = 20 $\mu H, \, I_{AS}$ =90 A







FR-4 25.4 × 25.4 × 1.6 (Unit: mm) 2 oz copper

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} = ±20 V,V _{DS} = 0 V	_	_	±0.1	μA
Drain cut-off current	I _{DSS}	V _{DS} = 100 V, V _{GS} = 0 V	_	_	10	
Drain-source breakdown voltage	V _{(BR)DSS}	I _D = 10 mA, V _{GS} = 0 V	100	_	—	V
Drain-source breakdown voltage (Note 6)	V _{(BR)DSX}	I _D = 10 mA, V _{GS} = -20 V	65	_	—	
Gate threshold voltage	V _{th}	V _{DS} = 10 V, I _D = 1 mA	1.5		2.5	
Drain-source on-resistance	R _{DS(ON)}	V _{GS} = 4.5 V, I _D = 20 A	_	4.1	6.2	mΩ
		V _{GS} = 10 V, I _D = 45 A		3.1	3.7	

Note 6: If a reverse bias is applied between gate and source, this device enters V_{(BR)DSX} mode. Note that the drainsource 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} = 50 V, V _{GS} = 0 V, f = 1 MHz	—	4850	6300	pF
Reverse transfer capacitance	C _{rss}		—	29	59	
Output capacitance	C _{oss}		_	640	_	
Gate resistance	rg	_	_	2.1	3.2	Ω
Switching time (rise time)	t _r	See Fig. 6.2.1	_	10	_	ns
Switching time (turn-on time)	t _{on}		_	21	_	
Switching time (fall time)	t _f			19	—	
Switching time (turn-off time)	t _{off}			68	_	

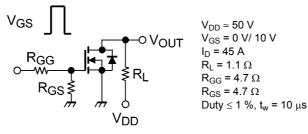


Fig. 6.2.1 Switching Time Test Circuit

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

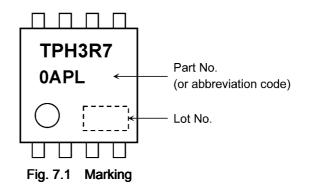
Characteristics	Symbol	Test Condition	Min	Тур.	Max	Unit
Total gate charge (gate-source plus	Qg	$V_{DD} \approx 50$ V, V_{GS} = 10 V, I_D = 45 A	_	67	_	nC
gate-drain)		$V_{DD} \approx 50$ V, V_{GS} = 4.5 V, I_D = 45 A		33		
Gate-source charge 1	Q _{gs1}	$V_{DD} \approx 50 \text{ V}, \text{ V}_{GS}$ = 10 V, I _D = 45 A	_	16	_	
Gate-drain charge	Q _{gd}			14	_	
Gate switch charge	Q _{SW}			21	_	
Output charge	Q _{oss}	V _{DS} = 50 V, V _{GS} = 0 V, f = 1 MHz	_	74	_	

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

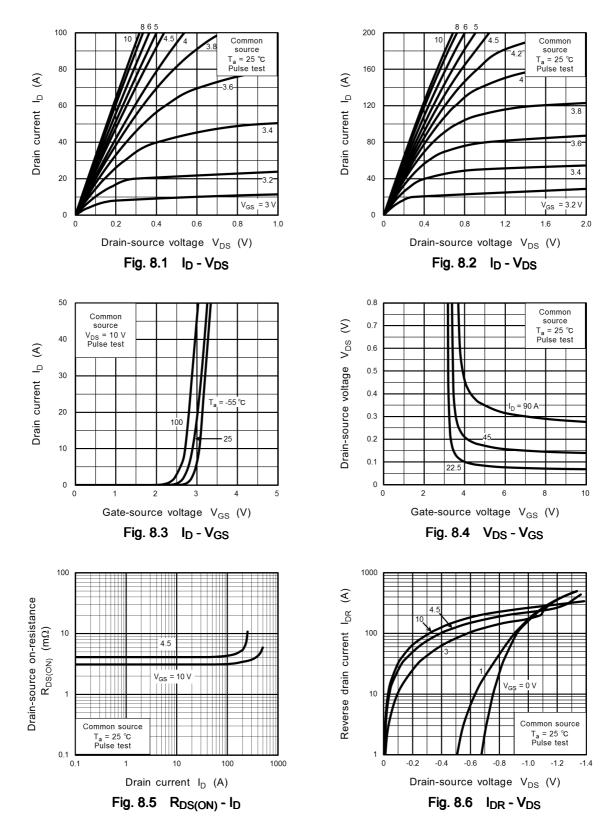
Characteristics		Symbol	Test Condition	Min	Тур.	Max	Unit
Reverse drain current (pulsed)	(Note 7)	I _{DRP}	(t = 100 μs)	_	—	500	А
Diode forward voltage		V _{DSF}	I _{DR} = 90 A, V _{GS} = 0 V	_	_	-1.2	V
Reverse recovery time		t _{rr}	I _{DR} = 22.5 A, V _{GS} = 0 V,	_	53	_	ns
Reverse recovery charge		Q _{rr}	-dI _{DR} /dt = 100 A/µs	_	74	_	nC

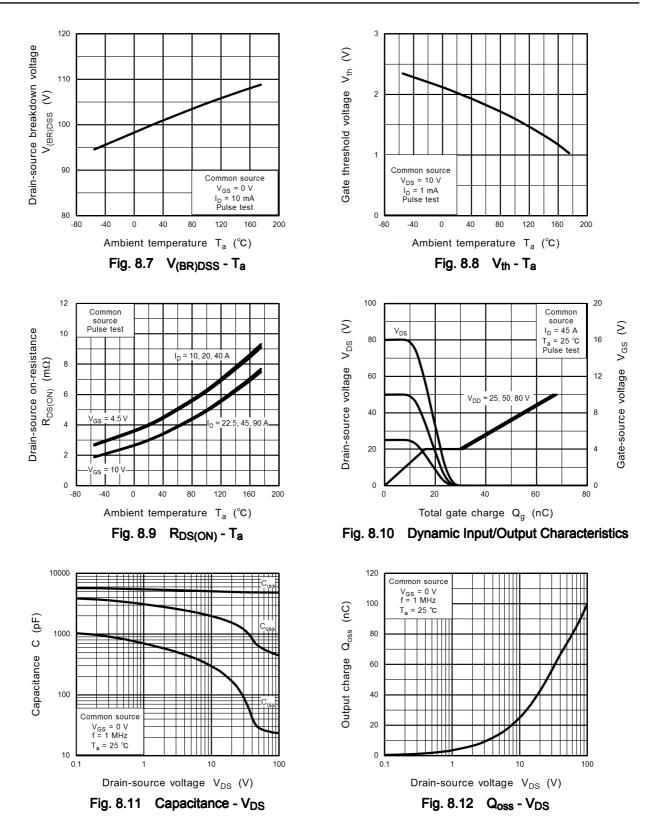
Note 7: Ensure that the channel temperature does not exceed 175 °C.

7. Marking

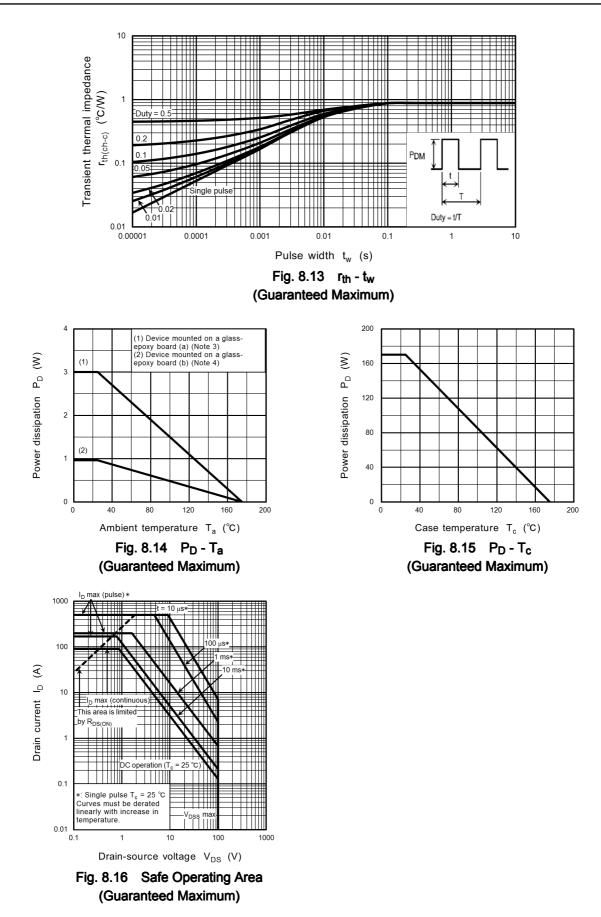


8. Characteristics Curves (Note)







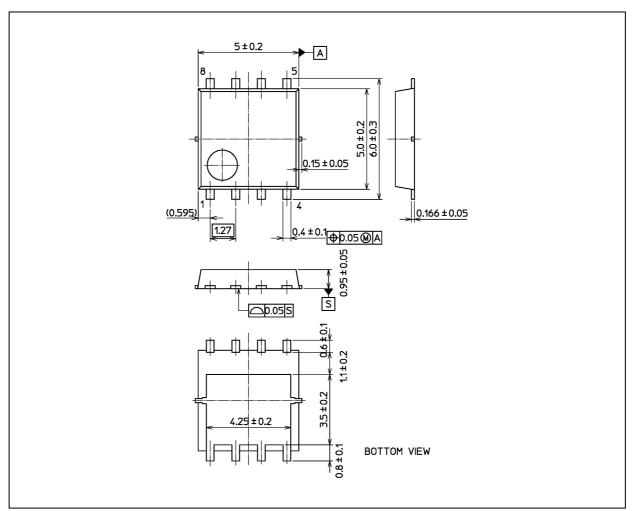


Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

TPH3R70APL

Package Dimensions

Unit: mm



The package can be selected according to your preference. For details, please contact your TOSHIBA sales representative.

Weight: 0.087 g (typ.)

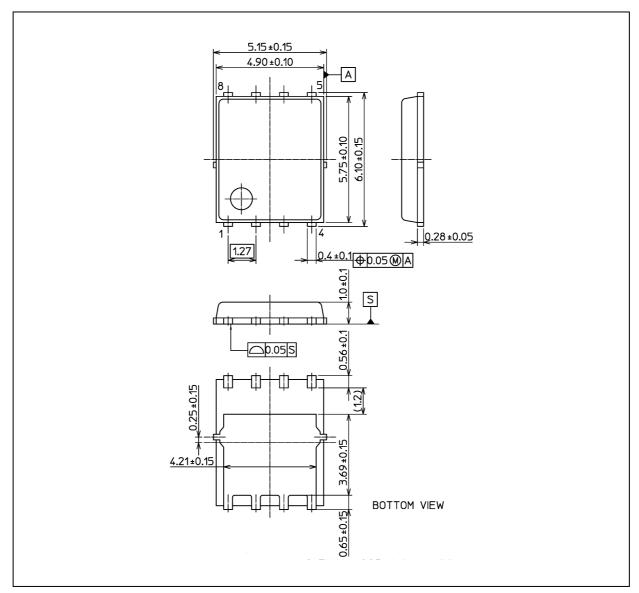
	Package Name(s)
TOSHIBA: 2-5Q1S	
Nickname: SOP Advance	



TPH3R70APL

Package Dimensions

Unit: mm



The package can be selected according to your preference. For details, please contact your TOSHIBA sales representative.

Weight: 0.111 g (typ.)

Package Name(s)
TOSHIBA: 2-5W1A
Nickname: SOP Advance(N)

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