TOSHIBA
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Semiconductor Catalog Mar. 2018

U-MOSIX/U-MOSVIII Series

Low Voltage MOSFETs

Gen-9 and Gen-8 High-Performance U-MOS Series That Help Save Energy

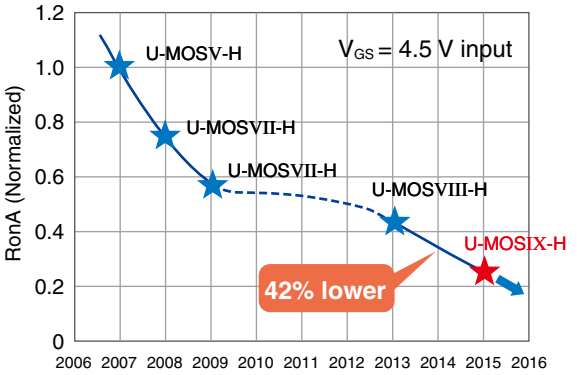
Low-V_{DSS} MOSFETs

Toshiba has used each successive generation of fabrication processes and steadily optimized the device structure to reduce the power losses of its low-voltage power MOSFETs.

Features

- Low on-resistance due to the use of a small-geometry process
- Low power losses due to a greatly improved trade-off between on-resistance and charge characteristics
- MOSFETs with a wide range of V_{DSS} and extensive packaging options suitable for various applications
- High avalanche ruggedness and ESD tolerance
- Device structure designed to reduce switching noise and thus simplify system design

[Continual Reduction in On-Resistance of 30-V MOSFETs]



RonA: Drain-source on-resistance per unit area

U-MOSIX and U-MOSVIII Series

The high-performance U-MOSIX and U-MOSVIII-H series combine low on-resistance and high switching speed and are available with a wide range of V_{DSS} from 30 V to 250 V.

[Comparison of Coverage of the U-MOSVIII-H and U-MOSIX-H Series]

Drain-Source on-resistance $R_{DS\ (ON)}$ (Max) @V_{GS} = 10 V (mΩ)	Drain-Source voltage V_{DSS} (V)										
	30 V	40 V	45 V	60 V	75 V	80 V	100 V	120 V	150 V	200 V	250 V
100–200											
50–100											
20–50											
10–20											
5–10											
3–5											
1–3											
0.7–1											
0.7 less than											

Double-Sided-Cooling Package DSOP Advance

1. The DSOP Advance package efficiently dissipates heat from the metal plates on the top and bottom surfaces.

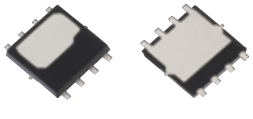
The DSOP Advance package provides a higher current capacity than the conventional package with the same size and therefore helps save PCB space and reduce the system size.

2. The DSOP Advance package is footprint-compatible with the SOP Advance package.

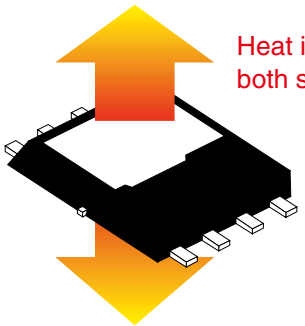
MOSFETs in the DSOP Advance package serve as easy replacements for those in the SOP Advance package without the need for modifying the PCB layout.

3. The DSOP Advance package has lower resistance.

[DSOP Advance Package]



Top Bottom



Heat is efficiently dissipated from both sides.

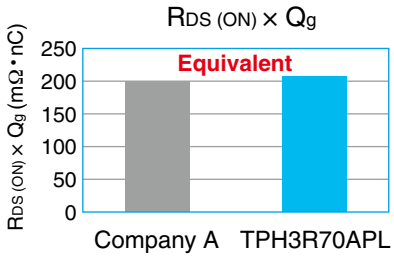
Features

1. Greatly improved trade-off between on-resistance and charge characteristics

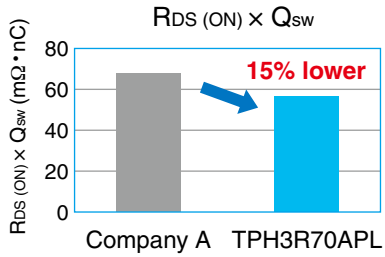
Fabricated with the latest process and the optimized cell structure, the U-MOSIX-H series provides a greatly improved trade-off between on-resistance and charge characteristics, which are important figures of merit for MOSFETs. Consequently, the U-MOSIX-H series provides significant reductions in major losses including conduction loss, drive loss, switching loss, and output charge loss, which help improve the efficiency of application systems and reduce the MOSFET device temperature.

Comparisons of $R_{DS\ (ON)} \times Q_{sw}$ (V_{DSS} = 100 V Series)

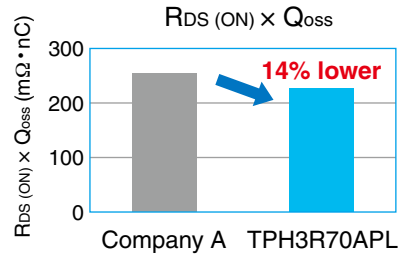
[Conduction and drive losses]



[Conduction and switching losses]



[Conduction and output charge losses]



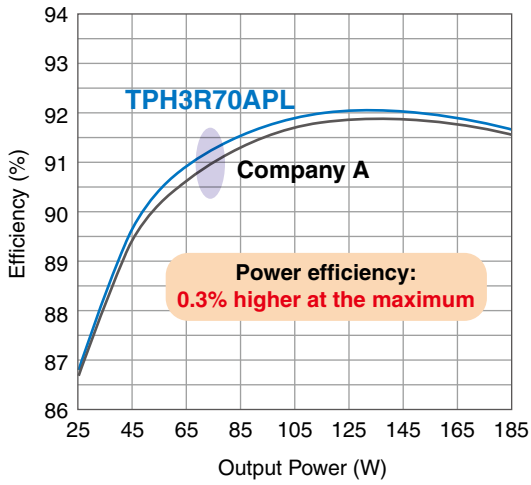
As of January 2018 (as surveyed by Toshiba)

$R_{DS\ (ON)}$: Drain-source on-resistance (mΩ) (figure of merit for conduction loss)
Q_g: Gate charge (nC) (figure of merit for drive loss)
Q_{sw}: Gate switch charge (nC) (figure of merit for switching loss)
Q_{oss}: Output charge (nC) (figure of merit for output charge loss)

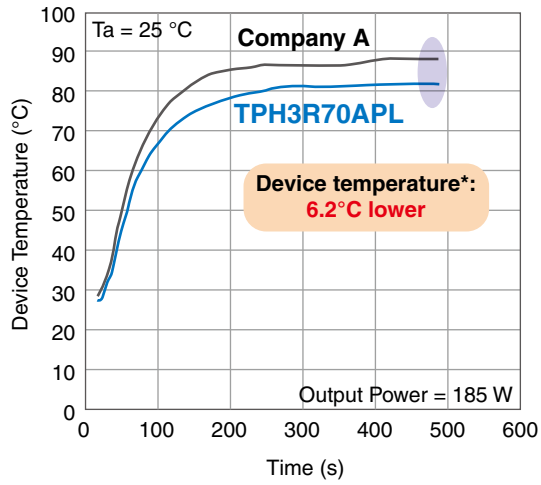
TPH3R70APL:
U-MOSIX-H, SOP Advance
V_{DSS} = 100 V,
$R_{DS\ (ON)}$ (Max) = 3.7 mΩ (V_{GS} = 10 V input)

Comparisons of efficiency and device temperature (Full-Bridge DC-DC Converter)

[Efficiency Comparison]



[Device Temperature Comparison]



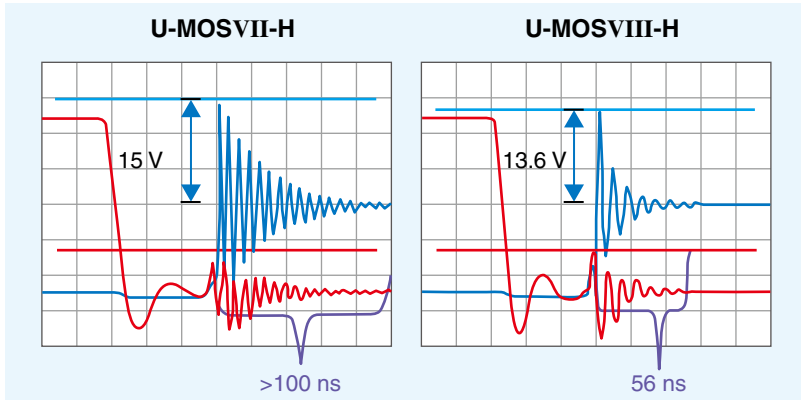
* At the center of the package mold surface

Operating conditions:
Input voltage = 48 V
Output voltage = 24 V
Output power = 25 to 185 W
Operating frequency: 150 kHz
MOSFET gate drive voltage = 6 V

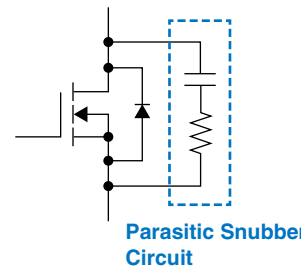
2. Reduction in switching noise

Due to the parasitic RC snubber between drain and source, the U-MOSVIII-H and U-MOSIX-H series help reduce noise and ringing during switching transitions.

[Comparison of Drain-Source Voltage Waveforms during Switch-Off Operation]



Test conditions:
V_{IN} = 12 V
V_{OUT} = 5 V
I_{OUT} = 12 A



3. Guaranteed at a channel temperature of up to 175°C

The MOSFETs of the U-MOSIX-H series, including those with a V_{DSS} of 30 V, are guaranteed at a channel temperature of up to 175°C and over a storage temperature range from −55°C to 175°C.

U-MOSIX/U-MOSVIII Series Lineup

V_{DSS} (V)	$R_{DS\ (ON)}$ max (mΩ)	TSON Advance	SOP Advance	SOP-8	DSOP Advance	TO-220	TO-220SIS	DPAK	D2PAK	DPAK+	D2PAK+	TO-220SM (W)
30	10 – 20	TPN11003NL	TPH11003NL									
	5 – 10	TPN8R903NL TPN6R303NC TPN6R003NL TPN5R203PL	TPH8R903NL TPH6R003NL	TP89R103NL TP86R303NL								
	3 – 5	TPN4R303NL TPN4R203NC	TPH4R803PL TPH4R003NL TPH3R203NL			TK3R3E03GL						
	1 – 3	TPN2R903PL TPN2R703NL TPN2R503NC TPN2R203NC TPN1R603PL	TPH3R003PL TPH2R903PL TPH2R003PL TPH1R403NL									
	< 1		TPHR9203PL TPHR9003NL TPHR9003NC TPHR6503PL		TPWR8503NL TPWR6003PL							
40	10 – 20									TK15S04N1L		
	5 – 10	TPN7R504PL	TPH7R204PL TPH6R004PL									
	3 – 5	TPN3R704PL	TPH3R704PC TPH3R704PL			TK3R1E04PL	TK3R1A04PL	TK3R1P04PL		TK65S04N1L		
	1 – 3	TPN2R304PL	TPH2R104PL TPH1R204PB TPH1R204PL							TK100S04N1L TK1R4S04PB	TK1R5R04PB	TK1R4F04PB
	< 1		TPHR8504PL		TPWR8004PL							TK200F04N1L TKR74F04PB
45	1 – 3	TPN2R805PL	TPH2R805PL TPH1R405PL TPH1R005PL									
	< 1				TPW1R005PL							
60	20 – 50	TPN22006NH										
	10 – 20	TPN14006NH TPN11006NL TPN11006PL	TPH14006NH TPH11006NL			TK30E06N1 TK40E06N1	TK30A06N1 TK40A06N1			TK25S06N1L TK40S06N1L		
	5 – 10	TPN7R506NH TPN7R006PL	TPH9R506PL TPH7R506NH TPH7R006PL TPH5R906NH			TK8R2E06PL TK58E06N1 TK5R1E06PL	TK8R2A06PL TK58A06N1 TK5R3A06PL	TK6R7P06PL				
	3 – 5	TPN4R806PL	TPH4R606NH TPH3R506PL			TK4R3E06PL TK3R2E06PL	TK4R3A06PL TK3R3A06PL	TK4R4P06PL		TK90S06N1L		
	1 – 3		TPH2R306NH TPH2R506PL TPH1R306PL TPH1R306P1		TPW1R306PL	TK100E06N1	TK100A06N1					
75	1 – 3		TPH2R608NH		TPW2R508NH							
80	30 – 50	TPN30008NH										
	10 – 20	TPN13008NH	TPH12008NH			TK35E08N1	TK35A08N1					
	5 – 10		TPH8R008NH			TK46E08N1	TK46A08N1					
	3 – 5		TPH4R008NH		TPW4R008NH	TK72E08N1 TK100E08N1	TK72A08N1 TK100A08N1					

V_{DSS} (V)	$R_{DS\ (ON)}$ max (mΩ)	TSON Advance	SOP Advance	SOP-8	DSOP Advance	TO-220	TO-220SIS	DPAK	D2PAK	DPAK+	D2PAK+	TO-220SM (W)
100	20 – 50	TPN3300ANH								TK11S10N1L TK7S10N1Z		
	10 – 20	TPN1600ANH TPN1200APL	TPH1400ANH			TK22E10N1 TK110E10PL	TK22A10N1 TK110A10PL	TK110P10PL				
	5 – 10		TPH8R80ANH TPH6R30ANL TPH5R60APL			TK34E10N1 TK40E10N1 TK7R2E10PL TK6R4E10PL	TK34A10N1 TK40A10N1 TK7R4A10PL TK6R7A10PL	TK7R7P10PL		TK33S10N1L TK33S10N1Z TK60S10N1L	TK60R10N1L	TK60F10N1L
	3 – 5		TPH4R50ANH TPH4R10ANL TPH3R70APL		TPW4R50ANH TPW3R70APL	TK65E10N1 TK3R9E10PL TK100E10N1	TK65A10N1 TK4R1A10PL TK100A10N1 TK3R2A10PL		TK65G10N1			TK160F10N1L TK160F10N1
	1 – 3					TK2R9E10PL						
120	10 – 20					TK32E12N1	TK32A12N1					
	5 – 10					TK42E12N1 TK56E12N1	TK42A12N1 TK56A12N1					
	3 – 5					TK72E12N1	TK72A12N1					
150	50 – 100	TPN5900CNH	TPH5900CNH									
	20 – 50		TPH3300CNH									
	10 – 20		TPH1500CNH		TPW1500CNH							
200	100 – 200	TPN1110ENH	TPH1110ENH									
	50 – 100		TPH6400ENH									
	20 – 50		TPH2900ENH		TPW2900ENH							
250	200 – 300	TPN2010FNH	TPH2010FNH									
	100 – 200		TPH1110FNH									
	50 – 100		TPH5200FNH		TPW5200FNH							

Part Naming Conventions

High-pin-count series

TPH 4R6 0 6 N H

- H: Additional information
- N: Product series
  N : U-MOSVIII/U-MOSVIII-H
  P : U-MOSIX/U-MOSIX-H
- 6: Maximum rated voltage
- 0: Polarity / internal connection
- 4R6: On-resistance (maximum rating under the maximum guaranteed drive conditions)
  R46 : $R_{DS\ (ON)}$ = 0.46 mΩ
  4R6 : $R_{DS\ (ON)}$ = 4.6 mΩ
  100 : $R_{DS\ (ON)}$ = 10 mΩ (= 10 x 10^0)
  101 : $R_{DS\ (ON)}$ = 100 mΩ (= 10 x 10^1)
- TPH: Package symbol

MOSFETs in a new 3-pin package

TK R74 F 04 P B

- B: Additional information
- P: Product series
  P : U-MOSIX/U-MOSIX-H
- 04: Maximum rated voltage V_{DSS} x 10%
- F: Package symbol
- R74: MOSFET with a V_{DSS} lower than 400 V
  R74 : $R_{DS\ (ON)}$ = 0.74 mΩ
  7R4 : $R_{DS\ (ON)}$ = 7.4 mΩ
  740 : $R_{DS\ (ON)}$ = 74 mΩ (= 74 x 10^0)
  741 : $R_{DS\ (ON)}$ = 740 mΩ (= 74 x 10^1)
- TK: Polarity

MOSFETs in a conventional 3-pin package

TK 11 S 10 N 1 L

- L: Additional information
- 1: Additional information
- N: Product series
  N : U-MOSVIII/U-MOSVIII-H
  P : U-MOSIX/U-MOSIX-H
- 10: Maximum rated voltage V_{DSS} x 10%
- S: Package symbol
- 11: Current rating
- TK: Polarity

This Catalog contains the latest information available as of January 1, 2018.

V_{DSS} (V): Drain-Source voltage
$R_{DS\ (ON)}$ (mΩ): Drain-Source on-resistance

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BCE0118B

U-MOSIX/U-MOSVIII Series
Low Voltage MOSFETs

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