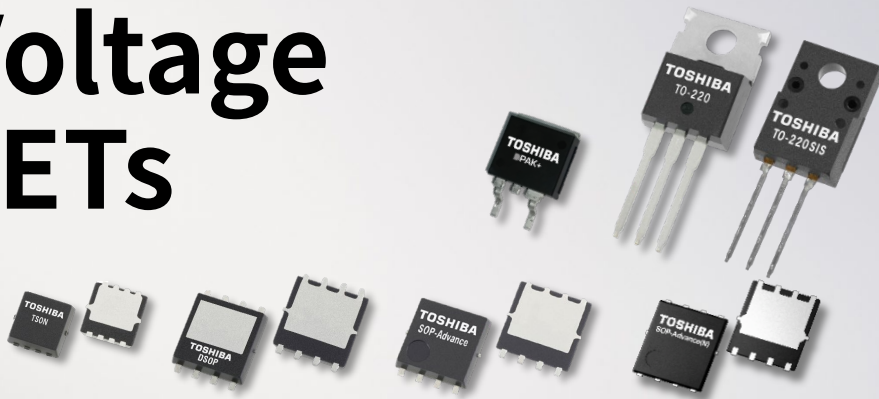


Low Voltage MOSFETs



Latest MOSFET Technology

U-MOS IX-H and X-H are high-efficiency Low Voltage (LV) MOSFET series, specifically designed for use in the secondary side of AC/DC power supplies for power adapters and servers as well as DC/DC power supplies for communication equipment such as servers and data center. The mentioned U-MOS –series are also suitable for motor drives, UPS and machine tools. U-MOS X-H and selected U-MOS IX-H are adopting a new cell structure that reduce the voltage spikes and ringing during switching which contributes for greater higher efficiency. Moreover the new SOP Advance (N) package in 5 x 6 mm dimension for improved compatibility is introduced .

Applications

- Power supplies
- Industry automation
- Servers
- Power adapters
- UPS
- Power tools
- Battery packs

Features

- Latest U-MOS IX-H / X-H trench process, complementing U-MOS-VIII line-up to cover V_{DSS} (30V-250V) and $R_{DS(ON)}$ values down to 0.6m Ω
- Top-level performance in on-resistance per die area ($R_{ON} \cdot A$)
- Improving trade off between $R_{DS(ON)}$ and $Q_g/Q_{sw}/Q_{oss}$
- $T_{ch,max}$: 175°C since U-MOS IX-H
- Package option: double side cooling
- Low spike solutions since U-MOS IX-H

Advantages

- Wide product line-up is applicable in various power applications
- Significantly better trade-offs between on-resistance ($R_{DS(ON)}$) and charge characteristics allow high efficiency switching
- More thermal safety head room
- Ideal for applications that require power density, smaller size etc.
- Less EMI effects at low spike type

Benefits

- Attractive cost effects
 - Lower system costs due to fast switching & smaller form factor
 - Low service costs based on increased lifetime (cooler system) to reduce costs of operation failures
 - Flexible system costs by cost variations related to product construction (topology)
- Smart performance increases
 - Improved end product quality
 - Improved competitiveness

U-MOS - series

Application examples

U-MOS X-H: low spike, $T_{ch,max}$: 175°C, narrow V_{th} distribution, **NEW** Improved $R_{DS(ON)} \times Q_g$, $R_{DS(ON)} \times Q_{sw}$, $R_{DS(ON)} \times Q_{oss}$

For server, DC/DC converter, synchronous rectifier

U-MOS IX-H: $T_{ch,max}$: 175°C, low Q_{oss} & low Q_{sw}

For server, DC/DC converter, motor drives, power supply

U-MOS VIII-H: up to high voltages 250V

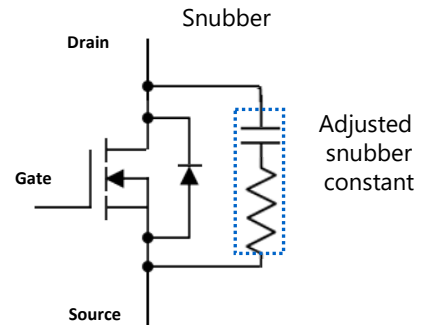
For general switching

U-MOS highlights

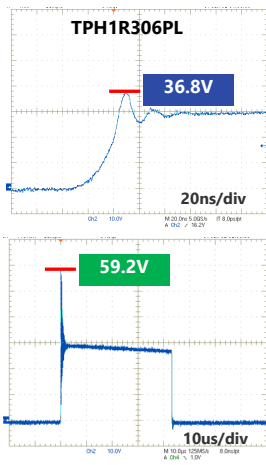
Aiming to simplify design engineer's job whilst offering maximized MOSFET performance, Toshiba developed various solutions.

Low spike technology

Toshiba is enabling switching noise reduction by adopting improved snubber functionality for selected 40V & 60V U-MOS IX-H and all U-MOS X-H series. With this new technology, Toshiba can offer low voltage spike and ringing for both resistive and inductive loads.



TPH1R306PL high speed switch type



Example:

60V, 1.3mΩ

SOP Advance (5x6mm)

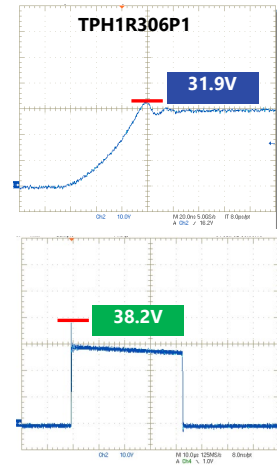
R-load switching waveform

$V_{DD}=30V$, $I_D=50A$
 $R_G=4.7\Omega$, $R_{GS}=4.7\Omega$
 Resistance load
 $T_a=25^\circ C$

L-load switching waveform (t_{rr})

$V_{DD}=30V$
 $I_{DR}=25A$
 $di/dt=220A/\mu s$
 $T_a=25^\circ C$

TPH1R306P1 low spike type



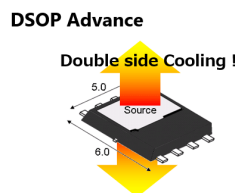
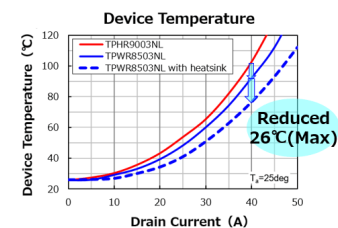
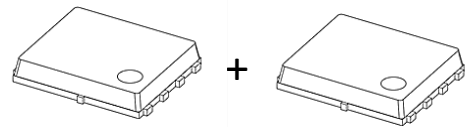
Improved V_{th} distribution for simplified paralleling of MOSFETs

Since U-MOS X-H the distribution of threshold voltage is narrowed.

UMOS VIII-H example: TPH4R008NH $V_{gs(th)}$ between 2.0V~4.0V → 2V window.

UMOS X-H example: TPH4R008QM $V_{gs(th)}$ between 2.5V~3.5V → 1V window.

Advantage: Simplified paralleling in power applications is possible.



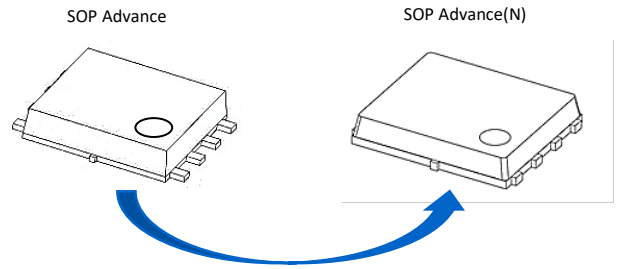
Dual side cooling

The DSOP double-side cooling package can use the same footprint as the 5x6mm SOP-Advanced. Due to the strongly reduced thermal resistance, the maximum load can be increased considerably. Alternatively the MOSFET temperature can be reduced to increase long term reliability.

Same chip inside

New SOP Advance (N) package

Toshiba is offering beside SOP Advance an additional package option for the surface mounted 5x6mm: SOP Advance(N), targeting to improve foot print compatibility. Where available, the datasheet will indicate both options.



U-MOS VIII-H, U-MOS IX-H & U-MOS X-H – Product line-up 30V ~ 60V

V_{DS} (V)	$R_{DS(ON)}$ in $m\Omega$	TO-220SIS	TO-220	SOP Advance 5x6mm	SOP Advance (N) 5x6mm	DSOP Advance 5x6mm	TSON Advance 3x3mm	DPAK
30	10-20			TPH11003NL			TPN11003NL	
	5-10			TPH8R903NL TPH6R003NL			TPN8R903NL TPN6R003NL TPN5R203PL*	
	3-5			TPH4R803PL* TPH4R003NL TPH3R203NL			TPN4R303NL	
	1-3			TPH3R003PL* TPH2R903PL* TPH2R003PL*	TPH1R403NL1		TPN2R703NL TPN2R903PL* TPN1R603PL*	
	<1				TPHR9003NL1 TPHR9203PL1* TPHR6503PL1*	TPWR8503NL TPWR6003PL*		
40	5-10			TPH7R204PL* TPH6R004PL*			TPN7R504PL*	
	3-5	TK3R1A04PL*	TK3R1E04PL*	TPH3R704PL*			TPN3R704PL*	TK3R1P04PL*
	1-3			TPH2R104PL* NEW TPH1R204PB**	TPH1R204PL* TPH1R204PL1*		TPN2R304PL*	
	<1			NEW TPHR7404PU**	TPHR8504PL1*	TPWR8004PL*		
45	1-3			TPH1R405PL* TPH1R005PL*	TPW1R005PL*		TPN2R805PL*	
60	20-30						TPN22006NH	
	10-20	TK30A06N1 TK40A06N1	TK30E06N1 TK40E06N1	TPH14006NH TPH11006NL			TPN14006NH TPN11006PL*	
	5-10	TK58A06N1 TK8R2A06PL* TK5R3A06PL*	TK58E06N1 TK8R2E06PL* TK5R1E06PL*	TPH9R506PL* TPH7R506NH TPH7R006PL* TPH5R906NH			TPN7R506NH TPN7R006PL*	TK6R7P06PL*
	3-5	TK4R3A06PL* TK3R3A06PL*	TK4R3E06PL* TK3R2E06PL*	TPH4R606NH TPH3R506PL*			TPN4R806PL*	TK4R4P06PL*
	1-3	TK100A06N1	TK100E06N1	TPH1R306P1**	TPH1R306PL1* TPH2R506PL* TPH2R306PL1* TPH2R306NH1	TPW1R306PL*		

* U-MOS IX-H technology; ** U-MOS IX-H low spike technology; ***U-MOS X-H technology

U-MOS VIII-H, U-MOS IX-H & U-MOS X-H – Product line-up 75V ~ 150V

V_{DS} (V)	$R_{DS(ON)}$ in mΩ	TO-220SIS	TO-220	SOP Advance 5x6mm	SOP Advance(N) 5x6mm	DSOP Advance 5x6mm	TSON Advance 3x3mm	DPAK
75	1-3			TPH2R608NH		TPW2R508NH		
	20-50						TPN30008NH	
	10-20	TK35A08N1	TK35E08N1	TPH12008NH			TPN19008QM*** TPN12008QM***	
	5-10	TK46E08N1 TK72A08N1 TK6R8A08QM*** TK5R1A08QM***	TK46E08N1 TK72E08N1 TK7R0E08QM*** TK5R3E08QM***	TPH8R008NH NEW	TPH8R008QM*** NEW		TPN8R408QM***	TK6R9P08QM*** TK5R1P08QM***
80	2-5	TK3R2A08QM*** TK100A08N1 TK2R4A08QM***	TK3R3E08QM*** TK100E08N1 TK2R4E08QM***	TPH2R408QM***	NEW TPH4R008NH1 TPH4R008QM*** TPH3R008QM*** TPH2R408QM***	TPW4R008NH		
	20-50						TPN3300ANH	
	10-20	TK22A10N1 TK110A10PL*	TK22E10N1* TK110E10PL*	TPH1400ANH			TPN1600ANH TPN1200APL*	TK110P10PL*
	5-10	TK34A10N1 TK40A10N1 TK7R4A10PL* TK6R7A10PL*	TK34E10N1 TK40E10N1 TK7R2E10PL* TK6R4E10PL*	TPH8R80ANH TPH6R30ANL TPH5R60APL*				TK7R7P10PL*
	3-5	TK65A10N1 TK4R1A10PL* TK100A10N1 TK3R2A10PL*	TK65E10N1 TK3R9E10PL* TK100E10N1	TPH4R10ANL	NEW TPH4R50ANH1 TPH3R70APL1* TPH3R10AQM***	TPW4R50ANH TPW3R70APL*		
100	<3		TK2R9E10PL*					
	10-20	TK32A12N1	TK32E12N1					
	5-10	TK42A12N1 TK56A12N1	TK42E12N1 TK56E12N1					
120	3-5	TK72A12N1	TK72E12N1					
	50-100			TPH5900CNH			TPN5900CNH	
	20-50			TPH3300CNH			NEW TPN4800CQH***	
150	5-20				NEW NEW NEW	TPH1500CNH1 TPH1400CQH*** TPH9R00CQH*** TPH9R00CQ5****	TPW1500CNH	
	100-200			TPH1110ENH			TPN1110ENH	
	50-100			TPH6400ENH				
200	20-50			TPH2900ENH		TPW2900ENH		
	200-300			TPH2010FNH			TPN2010FNH	
	100-200			TPH1110FNH				
250	100-200			TPH5200FNH		TPW5200FNH		
	50-100							

* U-MOS IX-H technology; ** U-MOS IX-H low spike technology; ***U-MOS X-H technology **** U-MOS X-H with high speed diode