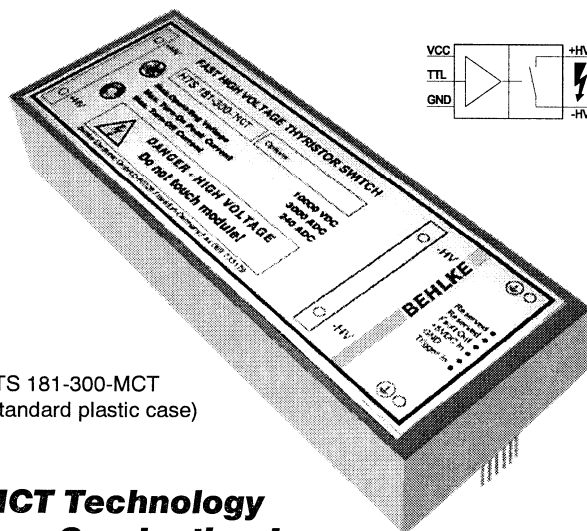


FAST HIGH VOLTAGE THYRISTOR SWITCHES

These solid-state switches are designed for high voltage high peak current switching applications such as piezo drivers, flash lamp drivers, crowbar circuits and power pulse generators. The switching modules described here are developed on the basis of a new type of thyristor, the so called MCT (MOS Controlled Thyristor). Thyristor switches made of MCT's combine low on-state conduction loss, high surge current capability and a certain capability for active turn-off. The turn-off capability is specified by the Maximum Controllable Turn-off Current rating $I_{off(max)}$. Provided this absolute maximum rating is not exceeded the on-time of MCT switches can be controlled between the Minimum On-Time $t_{on(min)}$ and infinity simply by the duration of the control signal.

Each switching module consists of a large number of MCT's which are connected in series and in parallel. The extremely fast and synchronous turn-on of all MCT's is performed by a special low impedance driver circuit, which provides also galvanic isolation from the control input. Internal current paths are optimized regarding stray inductance which allows extremely high rates of change of turn-on current. In contrast to conventional high voltage switches like spark gaps, electron tubes, gas discharge tubes and mechanical switches, thyristor switches of the series HTS-MCT show very low jitter and stable switching characteristics independent of temperature and age. The mean time between failures (MTBF) is by several orders of magnitude higher than that of classical HV switches. An interference-proof control circuit provides signal conditioning, auxiliary voltage monitoring, frequency limitation and temperature protection. In case of false operating conditions the switches are immediately turned-off and a fault signal is generated. An optional synchronization input allows the parallel interconnection of up to 50 switching modules to multiply the turn-on peak current of a single module (Option 01B). The switches are controlled by a positive going signal of 3 to 10 volts amplitude. Due to the limited reverse voltage (Cf. data table, V_{rb} parameter) MCT switches always have to be operated with fast free-wheeling diodes if inductive loads are connected. Due to the galvanic isolation the switches may simply be operated also in high-side circuits. The plastic case is the cost-effective standard package in applications with a low power dissipation. To increase the Maximum Continuous Power Dissipation $P_{d(max)}$ the modules can be additionally fitted with non-isolated cooling fins (Option 04). For detailed design recommendations please refer to the general instructions.

- HTS 121-300-MCT** 12000 V / 3000 A (pk)
- HTS 151-300-MCT** 15000 V / 3000 A (pk)
- HTS 181-300-MCT** 18000 V / 3000 A (pk)

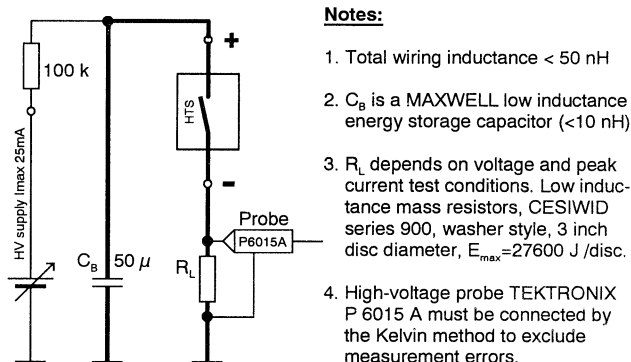


HTS 181-300-MCT
(Standard plastic case)

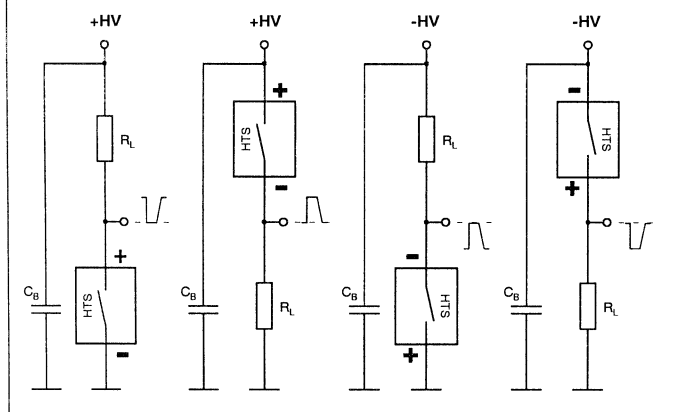
MCT Technology
Low Conduction Loss
200A Turn-Off Capability

Patented

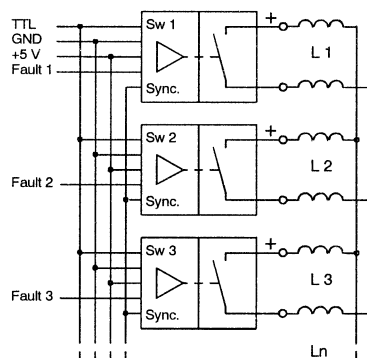
Test Circuit for $t_{r(on)}$



Basic Circuits

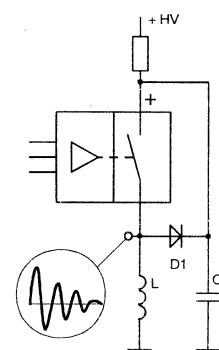


Parallel Connection



Note: Symmetrical layout is recommended for good dynamic current sharing (Wiring inductance L1 to Ln should be equal).

Inductive Load



Note: D1 is a fast recovery diode with Kiloamps peak current capability (E.g. Behlke Series FDA)

TECHNICAL DATA

Specification	Symb.	Condition / Comment	121-300-MCT	151-300-MCT	181-300-MCT	Unit
Maximum Operating Voltage	$V_{O(max)}$	$I_{off} < 300 \mu ADC$, $T_{case} = 70^\circ C$	12000	15000	18000	VDC
Minimum Operating Voltage	$V_{O(min)}$			0		VDC
Typical Breakdown Voltage	V_{br}	$I_{off} > 3 mADC$, $T_{case} = 70^\circ C$	14000	17000	20000	VDC
Maximum Reverse Voltage	V_{rb}		70	85	100	VDC
Maximum Off-State Current	I_{off}	$0.8 \times V_O$, $T_{case} = 25^\circ C$		250		μADC
Galvanic Isolation	V_I	HV side against control side		20000		VDC
Maximum Turn-On Peak Current	$I_{P(max)}$	$T_{case} = 25^\circ C$ $t_p < 100 \mu s$, duty cycle $< 1\%$ $t_p < 500 \mu s$, duty cycle $< 1\%$ $t_p < 1 ms$, duty cycle $< 1\%$		3000 2000 1000		ADC
Max. Non-repetitive Peak Current	$I_{P(nr)}$	$T_{case} = 25^\circ C$ Half sine single pulse, $t_p < 200 \mu s$		4000		
Max. Continuous Load Current	I_L	$T_{case} = 25^\circ C$ $T_{fin} = 25^\circ C$ Standard plastic case Opt. 04, cooling fins (air $> 4m/s$)	1.14 14	1.18 14	1.1 14	ADC
Maximum Controllable Turn-Off Current (Cf. note 1)	$I_{off(max)}$	$T_{case} = 70^\circ C$ $0.5 \times V_{O(max)}$ $0.8 \times V_{O(max)}$		200 100		ADC
Typical On-State Voltage	V_{sat}	$T_{case} = 25^\circ C$ $t_p < 10 \mu s$, duty cycle $< 1\%$ $0.01 \times I_{P(max)}$ $0.1 \times I_{P(max)}$ $1.0 \times I_{P(max)}$	15 25 49	19 31 60	22 36 70	VDC
Turn-On Delay Time	$t_{d(on)}$	@ $I_{P(max)}$, resistive load, 50-50%		550		ns
Typical Turn-On Rise Time	$t_{r(on)}$	Resistive load, 10-80 % $0.1 \times V_{O(max)}$, $0.1 \times I_{P(max)}$ $0.8 \times V_{O(max)}$, $0.1 \times I_{P(max)}$ $0.8 \times V_{O(max)}$, $1.0 \times I_{P(max)}$	270 110 200	285 140 210	310 150 240	ns
Typical Turn-Off Delay Time	$t_{d(off)}$	$0.8 \times V_{O(max)}$, @ $I_{off(max)}$, resistive load, 50-50%		2.1		μs
Typical Turn-Off Rise Time	$t_{r(off)}$	$0.8 \times V_{O(max)}$, @ $I_{off(max)}$, resistive load, 10/90%		1.5		μs
Critical Rate-of-Rise of Off-State Voltage	dv/dt	@ $V_{O(max)}$, exponential waveform	140	170	200	kV/ μs
Minimum On-Time (Cf. note 1)	$t_{on(min)}$	Standard Option 06, customized $t_{on(min)}$		1 1...1000		μs
Maximum On-Time	$t_{on(max)}$	Please note $P_{d(max)}$ limitations		∞		
Switch Recovery Time	t_{rc}	$t_{rc} + t_{on(min)}$ = minimum pulse spacing		2		μs
Typical Turn-On Jitter	$t_{j(on)}$	$V_{aux} / V_{tr} = 5.0 VDC$		1		ns
Max. Switching Frequency	$f_{r(max)}$	Please note $P_{d(max)}$ limitations,	3	2	1.5	kHz
Maximum Burst Frequency	$f_{b(max)}$	With option 01 only		330		kHz
Maximum Continuous Power Dissipation	$P_{d(max)}$	$T_{case} = 25^\circ C$ $T_{fin} = 25^\circ C$ Standard plastic case Opt. 04, cooling fins (air $> 4m/s$)	16 200	20 240	22 280	Watts
Linear Derating		Above $25^\circ C$ T_{case} / T_{fin} Standard plastic case Opt. 04, cooling fins (air $> 4m/s$)	0.36 4.44	0.44 5.33	0.49 6.22	W/K
Temperature Range	T_O	Extended range on request		-40...70		$^\circ C$
Coupling Capacitance	C_C	HV side against control side	16	20	35	pF
Auxiliary Supply Voltage	V_{aux}	Stabilized to $\pm 5\%$		5.0 ($\pm 5\%$)		VDC
Auxiliary Supply Current	I_{aux}	@ f_{max}		500		mADC
Control Signal	V_{tr}			3-10		VDC
Fault Signal		L=Fault		H= 4 V, L= 0.5 V		VDC
Dimensions		Standard case, reduced size on request With option 04 (cooling fins)		178x64x31 178x64x66		mm ³
Weight		Standard case, reduced weight on request With option 04 (cooling fins)	590 740	620 790	650 850	g

Note 1) MCT switches have a limited turn-off capability which is specified by $I_{off(max)}$. This parameter is an absolute maximum rating and must not be exceeded. In high peak current discharge applications the switch has to be kept actively in on-state until the discharge current drops safely below $I_{off(max)}$. Time constants longer than $1 \mu s$ require option 06 (customized on-time extension, $1 \mu s$ to 1 ms) for maximum switch protection.

Ordering Informations

HTS 121-300-MCT	Thyristor switch, 12000 VDC, 3000 A (pk)	Option 02	Flame retardend casting resin UL94-VO
HTS 151-300-MCT	Thyristor switch, 15000 VDC, 3000 A (pk)	Option 03	Increased thermal conductivity (plastic case only)
HTS 181-300-MCT	Thyristor switch, 18000 VDC, 3000 A (pk)	Option 04	Cooling fins (fins are on high voltage potential)
Option 01 A	High frequency burst	Option 06	Customized $t_{on(min)}$ from 1 to 1000 μs . Please refer to note 1)
Option 01 B	Synchronization input / output		

All data and specifications subject to change without notice. Custom designed devices on request.

181-300-MCT-01.00