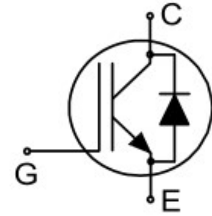
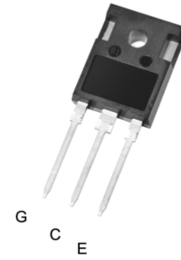
HC50N75

50A/750V
Trench FS IGBT

Features and Benefits:
- Plug and play replacement of previous generation IGBTs
- 750V breakdown voltage
- Low gate charge Q_G
- Maximum junction temperature 175°C
- Qualified according to JEDEC for target applications
- Pb-free lead plating; RoHS compliant





Applications:
- Uninterruptible power supplies
- Solar converters
- Welding converters
- Mid to high range switching frequency converters

Package pin definition:
- Pin 1 - gate
- Pin 2 & backside - collector
- Pin 3 – emitter

Key Performance and Package Parameters

Type	V_{CE}	I_C	V_{CEsat} , T_{vj} =25°C	T_{vjmax}	Marking	Package
HC50N75	750V	50A	1.89V	175°C	HC50N75	TO-247

Absolute maximum ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage, $T_{vj} \geq 25°C$	V_{CE}	750	V
DC collector current, limited by T vjmax T_C = 25°C value limited by bondwire T_C = 100°C	I_C	80 50	A
Pulsed collector current, t_p limited by T_{vjmax} [1]	I_{Cpuls}	200	A
Turn off safe operating area $V_{CE} \leq 650V$, $T_{vj} \leq 175°C$, t_p =1µs [1]	-	200	A
Diode forward current, limited by T_{vjmax} T_C=25°C value limited by bondwire T_C=100°C	I_F	80 50	A
Diode pulsed current, t_p limited by T_{vjmax} [1]	I_{Fpuls}	200	A
≤ 10µs, D < 0.010)	V_{GE} ±20 V	±30	
Power dissipation T_C = 25°C Power dissipation T_C =100°C	P_{tot}	294 147	W
Operating junction temperature	T_{vj}	-40...+175	°C
Storage temperature	T_{stg}	-55...+150	°C
Soldering temperature, wave soldering 1.6mm (0.063in.) from case for 10s		270	°C
Mounting torque, M3 screw, PG-TO247-pin123 Maximum of mounting processes: 3	M	0.6	Nm

Thermal Resistance

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
R_{th} Characteristics						
IGBT thermal resistance, junction - case	$R_{th(j-C)}$		-	0.51	-	ºC/W

Diode thermal resistance, junction - case	$R_{th(j-C)}$		-	0.71	-	°C/W
Thermal resistance junction - ambient	$R_{th(j-a)}$		-	31	-	°C/W

[1] Defined by design. Not subject to production test.

Electrical Characteristic, at T_{vj} = 25°C,unless otherwise specified

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
Static Characteristic						
Collector-emitter breakdown voltage	$V_{(BR)CES}$	V_{GE}=0V, I_C=0.2mA	750	-	-	V
Collector-emitter saturation voltage	V_{CEsat}	V_{GE}=15V,I_C=50A T_{vj}=25°C T_{vj}=125°C T_{vj}=175°C	- - -	1.89 2.37 2.65	2.10 - -	V
Diode forward voltage	V_F	V_{GE}=0V,I_F=50.0A T_{vj}=25°C T_{vj}=175°C	- - -	2.46 2.27 2.14	1.70 - -	V
Gate-emitter threshold voltage	$V_{GE(th)}$	I_C=0.5mA,V_{CE}=V_{GE}	5.5	6.1	6.5	V
Zero gate voltage collector current	I_{CES}	V_{CE}=650V,V_{GE}=0V T_{vj}=25°C T_{vj}=175°C	- -	0.022 278	50 -	μA
Gate-emitter leakage current	I_{GES}	V_{CE}=0V,V_{GE}=20V	-	-	100	nA
Transconductance	g_{fs}	V_{CE}=20V,I_C=50A	-	21.2	-	S

Electrical Characteristic, at Tvj =25°C,unless otherwise pecified

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
Dynamic Characteristic						
Input capacitance	C_{ies}	V_{CE}=25V,V_{GE}=0V,f=1MHz	-	2509	-	pF
Output capacitance	C_{oes}		-	165	-	
Reverse transfer capacitance	C_{res}		-	28	-	
Gate charge	Q_G	V_{CC}=520V,I_C=40A,V_{GE}=15V	-	100.4	-	nC

Switching Characteristic, Inductive Load

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
Dynamic Characteristic						
Turn-on delay time	$t_{d(on)}$	T_{vj}=25°C, V_{CC}=400V,I_C=50A, V_{GE}=0.0/15.0V, $R_{G(on)}$=12.0Ω,$R_{G(off)}$ =12.0Ω	-	33	-	ns
Rise time	t_r		-	141	-	ns
Turn-off delay time	$t_{d(off)}$		-	138	-	ns
Fall time	t_f		-	65	-	ns
Turn-on energy	E_{on}		-	3.2	-	mJ
Turn-off energy	E_{off}		-	1.1	-	mJ
Total switching energy	E_{ts}		-	4.3	-	mJ
Turn-on delay time	$t_{d(on)}$	T_{vj}=25°C, V_{CC}=400V,I_C=25A, V_{GE}=0.0/15.0V, $R_{G(on)}$=12.0Ω,$R_{G(off)}$ =12.0Ω,	-	25	-	ns
Rise time	t_r		-	61	-	ns
Turn-off delay time	$t_{d(off)}$		-	155	-	ns
Fall time	t_f		-	53	-	ns
Turn-on energy	E_{on}		-	1.1	-	mJ
Turn-off energy	E_{off}		-	0.5	-	mJ
Total switching energy	E_{ts}		-	1.6	-	mJ

Diode Characteristic, at T_{vj} =25°C

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
Dynamic Characteristic						
Diode reverse recovery time	t_{rr}	T_{vj}=25°C, V_R=400V, I_F=50A, di_F/dt=500A/μs	-	182	-	ns
Diode reverse recovery charge	Q_{rr}		-	1.35	-	μC
Diode peak reverse recovery current	I_{rrm}		-	17	-	A
Diode reverse recovery time	t_{rr}	T_{vj}=25°C, V_R=400V, I_F=25A, di_F/dt=500A/μs	-	167	-	ns
Diode reverse recovery charge	Q_{rr}		-	1.02	-	μC
Diode peak reverse recovery current	I_{rrm}		-	15	-	A

Switching Characteristic, Inductive Load

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
IGBT Characteristic, at T_{vj}=150°C						
Turn-on delay time	$t_{d(on)}$	T_{vj}=150°C, V_{CC}=400V,I_C=50A, V_{GE}=0.0/15.0V, $R_{G(on)}$=12.0Ω,$R_{G(off)}$ =12.0Ω	-	33	-	ns
Rise time	t_r		-	158	-	ns
Turn-off delay time	$t_{d(off)}$		-	158	-	ns
Fall time	t_f		-	108	-	ns
Turn-on energy	E_{on}		-	3.9	-	mJ
Turn-off energy	E_{off}		-	1.5	-	mJ
Total switching energy	E_{ts}		-	5.4	-	mJ
Turn-on delay time	$t_{d(on)}$	T_{vj}=150°C, V_{CC}=400V,I_C=25A, V_{GE}=0.0/15.0V, $R_{G(on)}$=12.0Ω,$R_{G(off)}$ =12.0Ω	-	24	-	ns
Rise time	t_r		-	62	-	ns
Turn-off delay time	$t_{d(off)}$		-	208	-	ns
Fall time	t_f		-	90	-	ns
Turn-on energy	E_{on}		-	1.1	-	mJ
Turn-off energy	E_{off}		-	0.8	-	mJ
Total switching energy	E_{ts}		-	1.9	-	mJ

Diode Characteristic, at T_{vj} =150°C

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
Dynamic Characteristic						
Diode reverse recovery time	t_{rr}	T_{vj}=150°C, V_R=400V, I_F=50A, di_F/dt=500A/μs	-	225	-	ns
Diode reverse recovery charge	Q_{rr}		-	4.5	-	μC
Diode peak reverse recovery current	I_{rrm}		-	37.7	-	A
Diode reverse recovery time	t_{rr}	T_{vj}=150°C, V_R=400V, I_F=25A, di_F/dt=500A/μs	-	207	-	ns
Diode reverse recovery charge	Q_{rr}		-	3.3	-	μC
Diode peak reverse recovery current	I_{rrm}		-	30.6	-	A

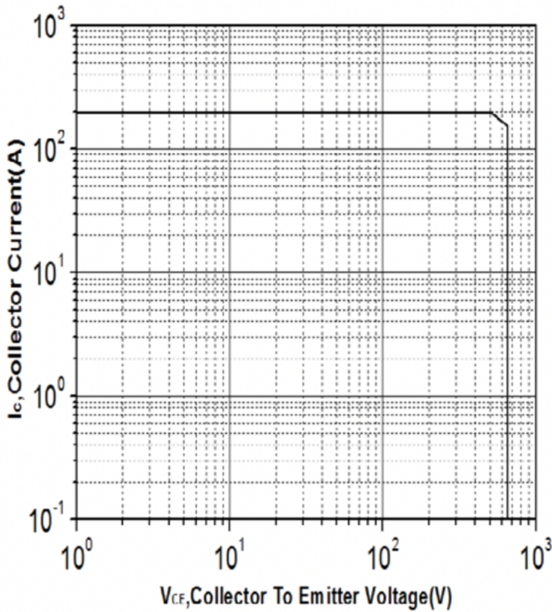


Figure 1. Forward bias safe operating area
($D=0, T_C=25°C, T_j≤175°C, V_{GE}=15V, t_p=1μs$, I_{Cmax} defined by design – not subject to production test)

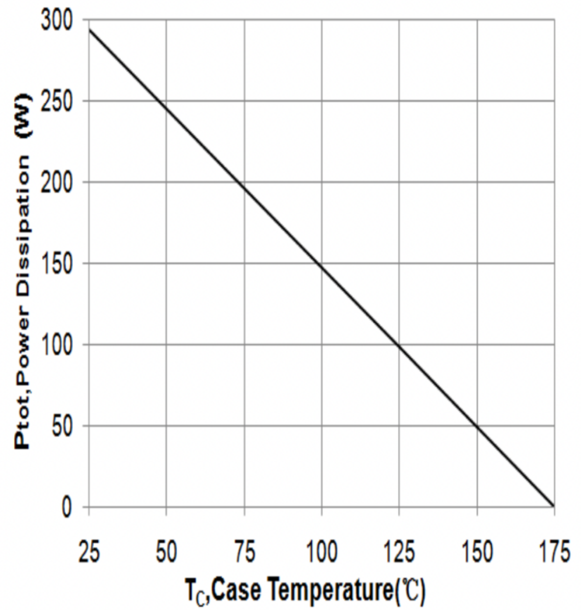


Figure 2. Power dissipation as a function of case temperature
(T_j ≤175°C)

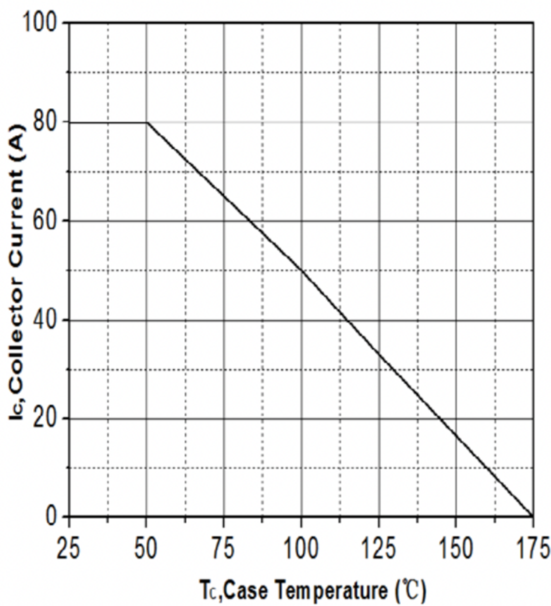


Figure 3. Collector current as a function of case temperature
(V_{GE} ≥15V, T_j ≤175°C)

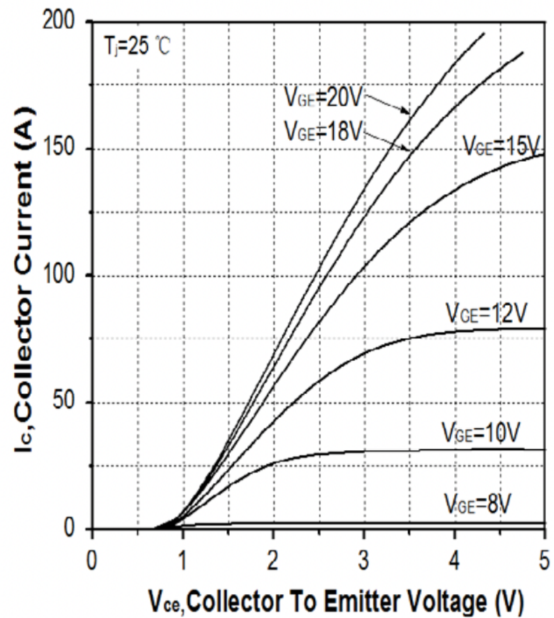


Figure 4. Typical output characteristic
(T_j =25°C)

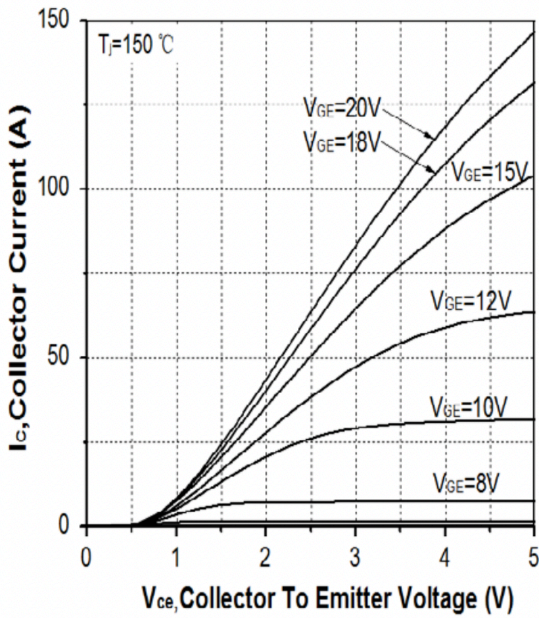


Figure 5. Typical output characteristic
(T_j =150°C)

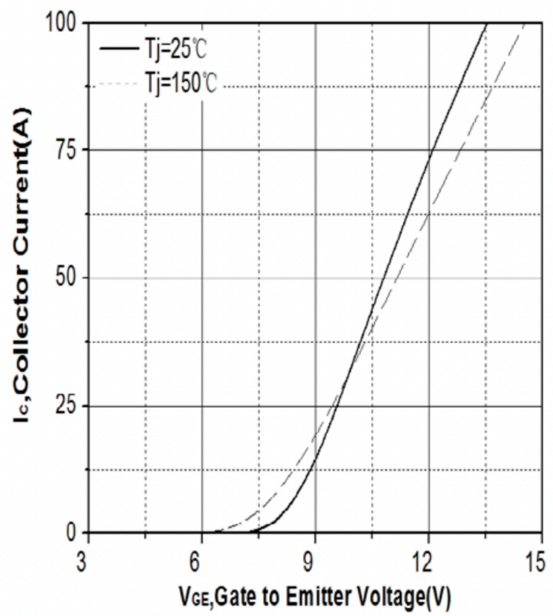


Figure 6. Typical transfer characteristic
(V_{CE} =20V)

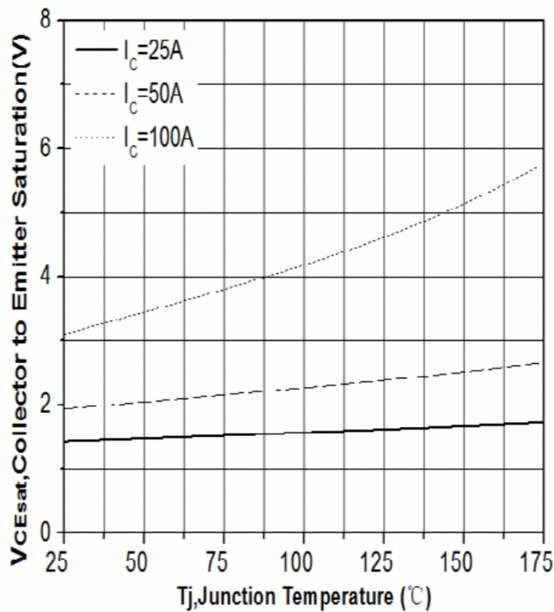


Figure 7. Typical collector-emitter saturation voltage as a function of junction temperature
(V_{GE} =15V)

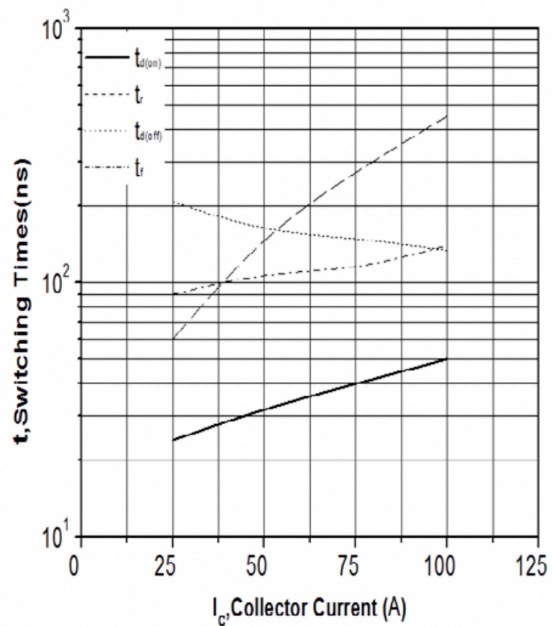


Figure 8. Typical switching times as a function of collector current
(inductive load, T_j =150°C, V_{CE} =400V, V_{GE} =0/15V, $R_{G(on)}$ =12Ω, $R_{G(off)}$ =12Ω, dynamic test circuit in Figure E)

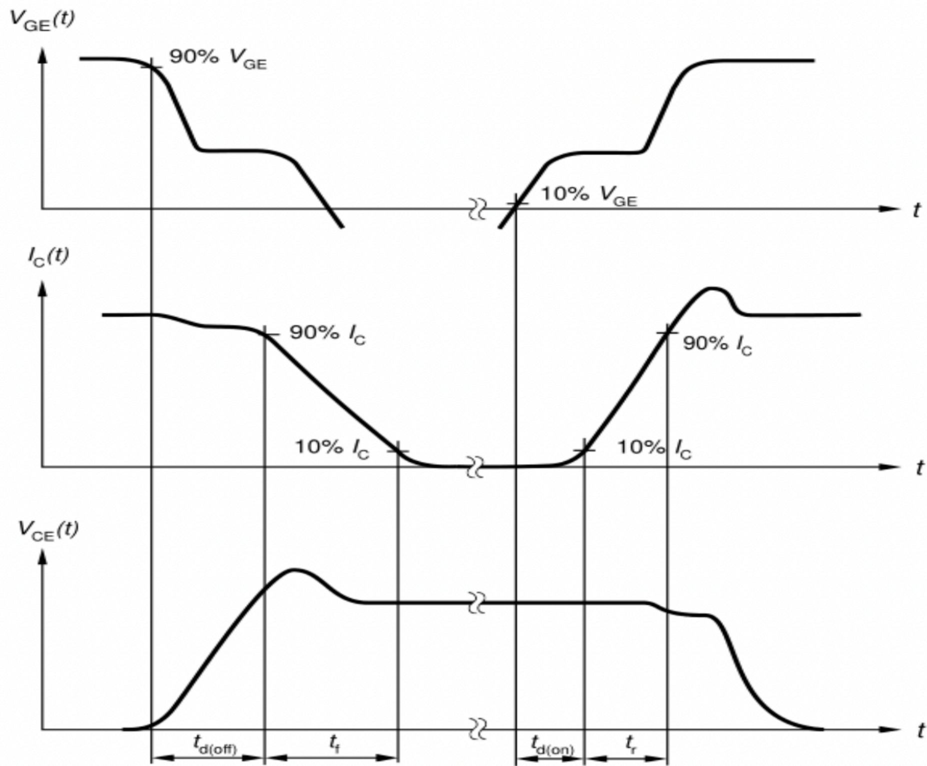


Figure A. Definition of switching times

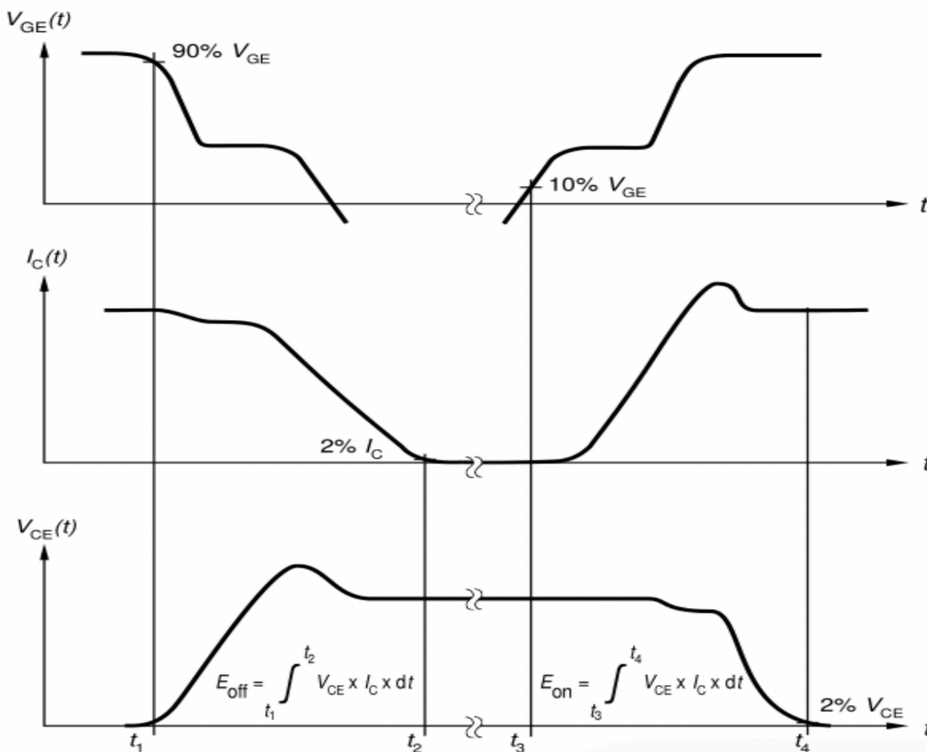


Figure B. Definition of switching losses

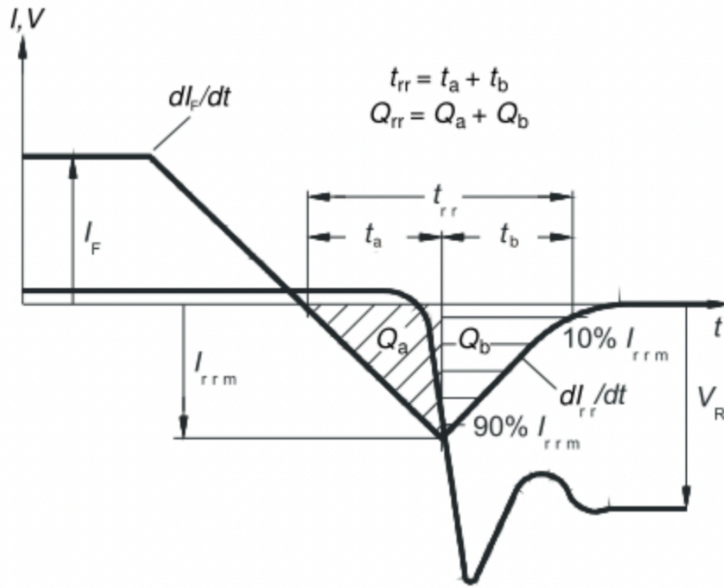


Figure C. Definition of diode switching characteristics

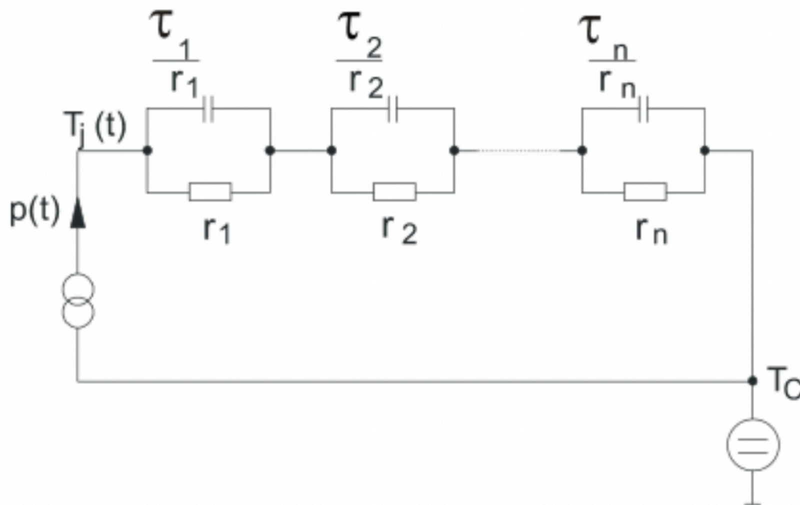


Figure D. Thermal equivalent circuit

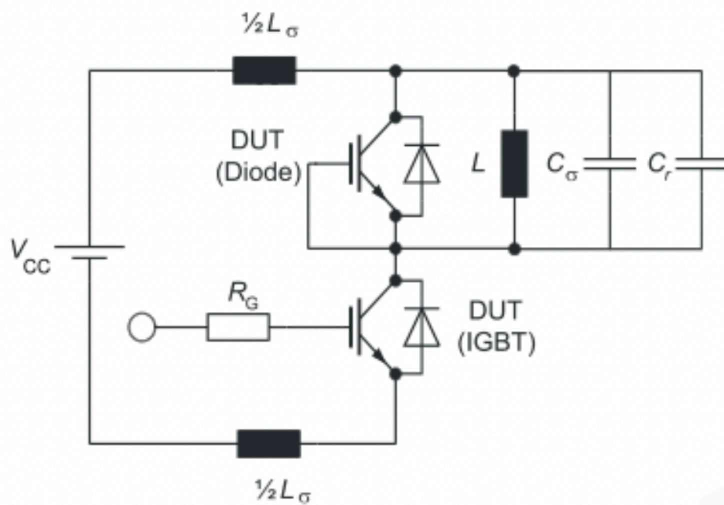


Figure E. Dynamic test circuit
Parasitic inductance L_{σ},
parasitic capacitor C_{σ},
relief capacitor C_{r},
(only for ZVT switching)