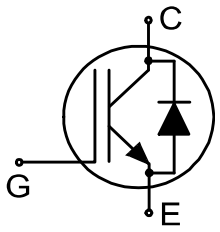
High speed DuoPack: IGBT in Trench and Fieldstop technology with soft, fast recovery anti-parallel diode

Features:

TRENCHSTOP™ technology offering
• very low V_{CEsat}
• low EMI
• Very soft, fast recovery anti-parallel diode
• maximum junction temperature 175°C
• qualified according to JEDEC for target applications
• Pb-free lead plating; RoHS compliant
• complete product spectrum and PSpice Models:
http://www.infineon.com/igbt/



Applications:

• uninterruptible power supplies
• welding converters
• converters with high switching frequency

Green

Halogen-Free

RoHS

Key Performance and Package Parameters

Type	V_{CE}	I_C	V_{CEsat}, T_{vj}=25°C	T_{vjmax}	Marking	Package
IKW30N60H3	600V	30A	1.95V	175°C	K30H603	PG-TO247-3

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Maximum ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage, $T_{vj} \geq 25°C$	V_{CE}	600	V
DC collector current, limited by T_{vjmax} $T_C = 25°C$ $T_C = 100°C$	I_C	 60.0 30.0	A
Pulsed collector current, t_p limited by T_{vjmax}	I_{Cpuls}	120.0	A
Turn off safe operating area $V_{CE} \leq 600V$, $T_{vj} \leq 175°C$, $t_p = 1\mu s$	-	120.0	A
Diode forward current, limited by T_{vjmax} $T_C = 25°C$ $T_C = 100°C$	I_F	 30.0 15.0	A
Diode pulsed current, t_p limited by T_{vjmax}	I_{Fpuls}	120.0	A
Gate-emitter voltage	V_{GE}	±20	V
Short circuit withstand time $V_{GE} = 15.0V$, $V_{CC} \leq 400V$ Allowed number of short circuits < 1000 Time between short circuits: ≥ 1.0s $T_{vj} = 150°C$	t_{SC}	 5	µs
Power dissipation $T_C = 25°C$ Power dissipation $T_C = 100°C$	P_{tot}	187.0 94.0	W
Operating junction temperature	T_{vj}	-40...+175	°C
Storage temperature	T_{stg}	-55...+150	°C
Soldering temperature, wave soldering 1.6 mm (0.063 in.) from case for 10s		260	°C
Mounting torque, M3 screw Maximum of mounting processes: 3	M	0.6	Nm

Thermal Resistance

Parameter	Symbol	Conditions	Max. Value	Unit
Characteristic				
IGBT thermal resistance, junction - case	$R_{th(j-c)}$		0.80	K/W
Diode thermal resistance, junction - case	$R_{th(j-c)}$		1.90	K/W
Thermal resistance junction - ambient	$R_{th(j-a)}$		40	K/W

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 = 2.00mA	600	-	-	V
Collector-emitter saturation voltage	V_{CEsat}	V_{GE} = 15.0V, I_C = 30.0A T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 175°C	 - - -	 1.95 2.30 2.50	 2.40 - -	V
Diode forward voltage	V_F	V_{GE} = 0V, I_F = 15.0A T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 175°C	 - - -	 1.65 1.67 1.65	 2.05 - -	V
Gate-emitter threshold voltage	$V_{GE(th)}$	I_C = 0.43mA, V_{CE} = V_{GE}	4.1	5.1	5.7	V
Zero gate voltage collector current	I_{CES}	V_{CE} = 600V, V_{GE} = 0V T_{vj} = 25°C T_{vj} = 175°C	 - -	 - -	 40.0 2000.0	µA
Gate-emitter leakage current	I_{GES}	V_{CE} = 0V, V_{GE} = 20V	-	-	100	nA
Transconductance	g_{fs}	V_{CE} = 20V, I_C = 30.0A	-	16.0	-	S

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

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
Dynamic Characteristic						
Input capacitance	C_{ies}	V_{CE} = 25V, V_{GE} = 0V, f = 1MHz	-	1630	-	pF
Output capacitance	C_{oes}		-	107	-	
Reverse transfer capacitance	C_{res}		-	50	-	
Gate charge	Q_G	V_{CC} = 480V, I_C = 30.0A, V_{GE} = 15V	-	165.0	-	nC
Internal emitter inductance measured 5mm (0.197 in.) from case	L_E		-	13.0	-	nH
Short circuit collector current Max. 1000 short circuits Time between short circuits: ≥ 1.0s	$I_{C(SC)}$	V_{GE} = 15.0V, V_{CC} ≤ 400V, t_{SC} ≤ 5µs T_{vj} = 150°C	-	 160	-	A

Switching Characteristic, Inductive Load

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
IGBT Characteristic, at T_{vj} = 25°C						
Turn-on delay time	$t_{d(on)}$	T_{vj} = 25°C, V_{CC} = 400V, I_C = 30.0A, V_{GE} = 0.0/15.0V, r_G = 10.5Ω, $L\sigma$ = 95nH, $C\sigma$ = 67pF $L\sigma$, $C\sigma$ from Fig. E Energy losses include “tail” and diode reverse recovery.	-	21	-	ns
Rise time	t_r		-	33	-	ns
Turn-off delay time	$t_{d(off)}$		-	207	-	ns
Fall time	t_f		-	22	-	ns
Turn-on energy	E_{on}		-	0.94	-	mJ
Turn-off energy	E_{off}		-	0.44	-	mJ
Total switching energy	E_{ts}		-	1.38	-	mJ
Diode reverse recovery time	t_{rr}	T_{vj} = 25°C, V_R = 400V, I_F = 15.0A, di_F/dt = 1000A/µs	-	38	-	ns
Diode reverse recovery charge	Q_{rr}		-	0.32	-	µC
Diode peak reverse recovery current	I_{rrm}		-	12.0	-	A
Diode peak rate of fall of reverse recovery current during t_b	di_{rr}/dt		-	-765	-	A/µs

Switching Characteristic, Inductive Load

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
IGBT Characteristic, at T_{vj} = 175°C						
Turn-on delay time	$t_{d(on)}$	T_{vj} = 175°C, V_{CC} = 400V, I_C = 30.0A, V_{GE} = 0.0/15.0V, r_G = 10.5Ω, $L\sigma$ = 95nH, $C\sigma$ = 67pF $L\sigma$, $C\sigma$ from Fig. E Energy losses include “tail” and diode reverse recovery.	-	20	-	ns
Rise time	t_r		-	30	-	ns
Turn-off delay time	$t_{d(off)}$		-	239	-	ns
Fall time	t_f		-	23	-	ns
Turn-on energy	E_{on}		-	1.12	-	mJ
Turn-off energy	E_{off}		-	0.60	-	mJ
Total switching energy	E_{ts}		-	1.72	-	mJ
Diode reverse recovery time	t_{rr}	T_{vj} = 175°C, V_R = 400V, I_F = 15.0A, di_F/dt = 1000A/µs	-	117	-	ns
Diode reverse recovery charge	Q_{rr}		-	1.08	-	µC
Diode peak reverse recovery current	I_{rrm}		-	16.6	-	A
Diode peak rate of fall of reverse recovery current during t_b	di_{rr}/dt		-	-530	-	A/µs

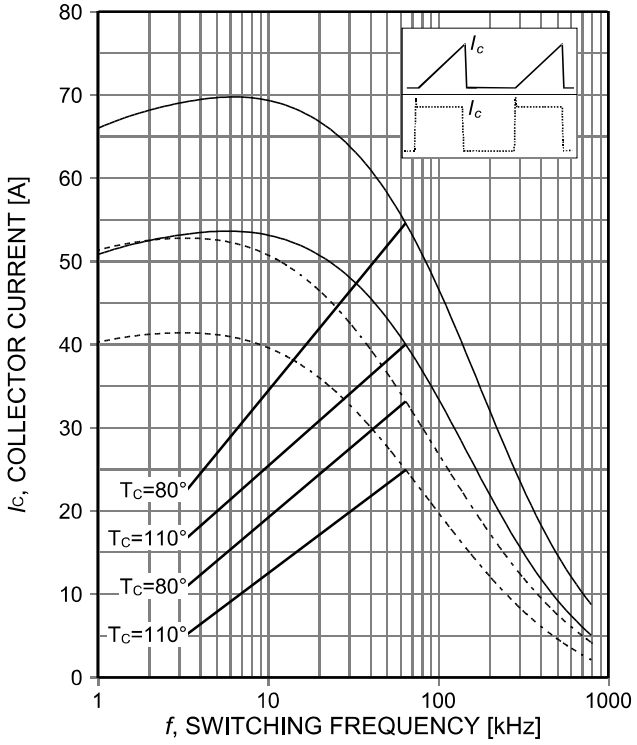

Figure 1. **Collector current as a function of switching frequency**
(T_j≤175°C, D=0.5, V_{CE}=400V, V_{GE}=15/0V, r_G=10,5Ω)

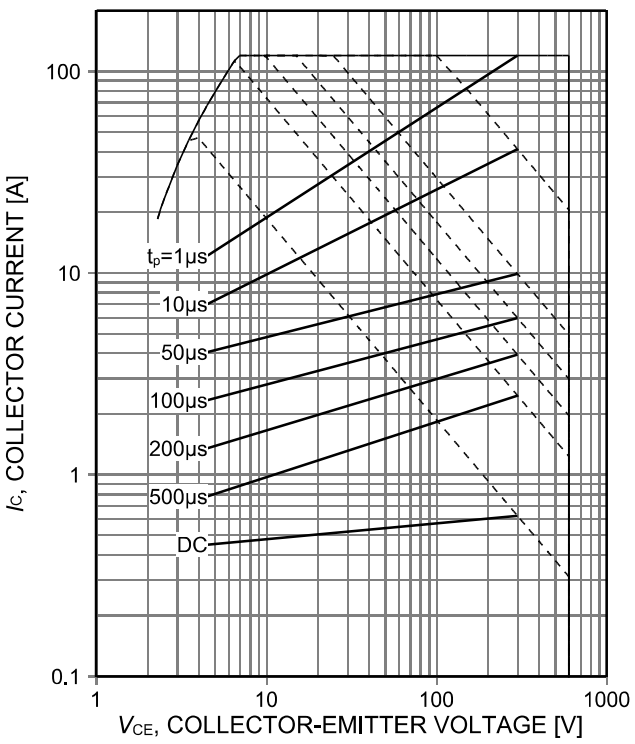

Figure 2. **Forward bias safe operating area**
(D=0, T_C=25°C, T_j≤175°C; V_{GE}=15V)

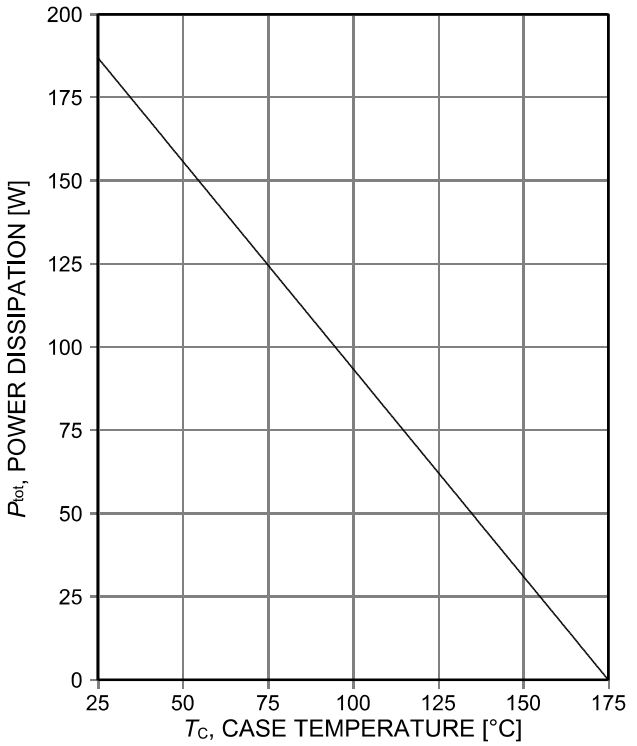

Figure 3. **Power dissipation as a function of case temperature**
(T_j≤175°C)

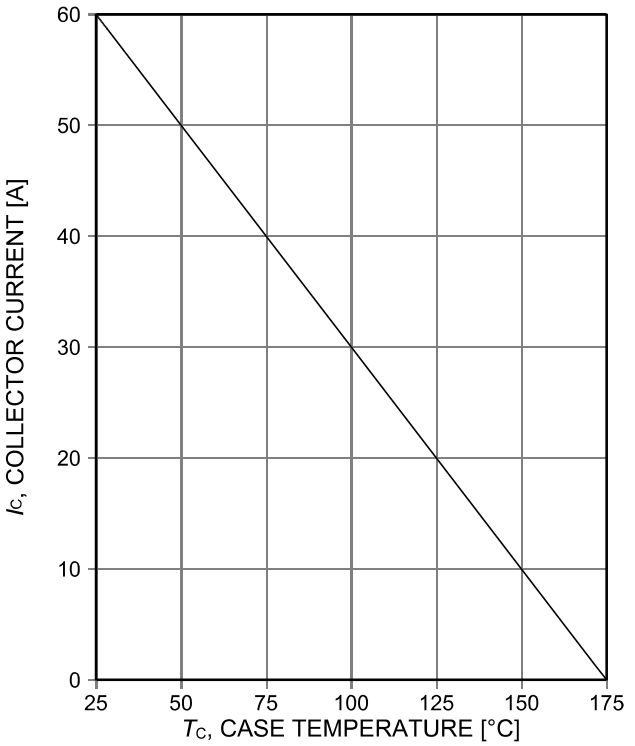

Figure 4. **Collector current as a function of case temperature**
(V_{GE}≥15V, T_j≤175°C)

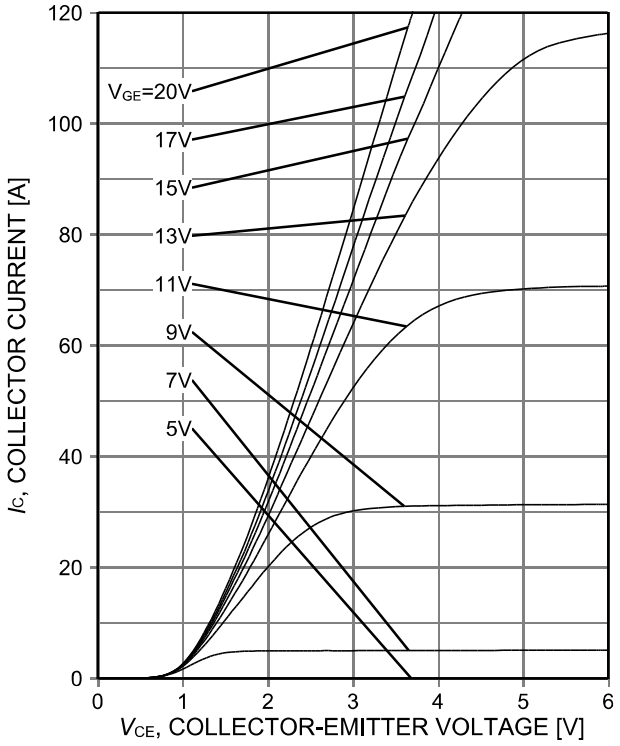

Figure 5. **Typical output characteristic**
(T_j=25°C)

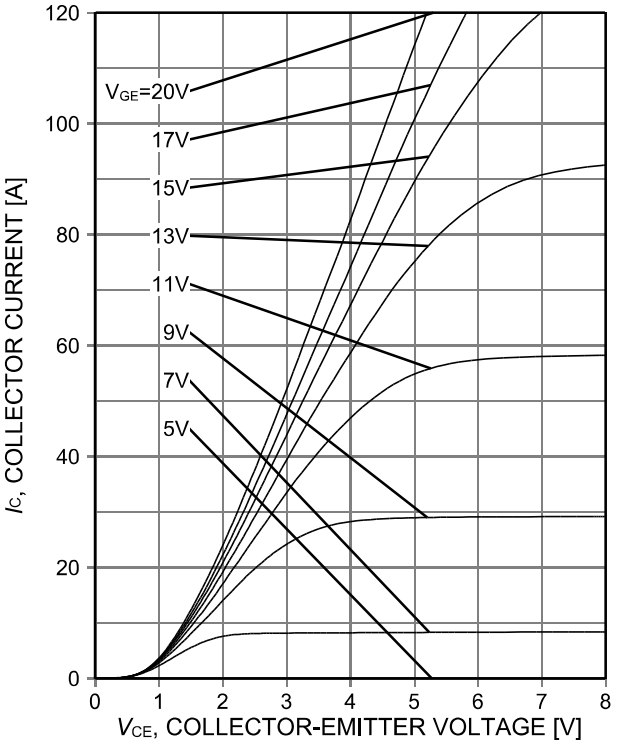

Figure 6. **Typical output characteristic**
(T_j=175°C)

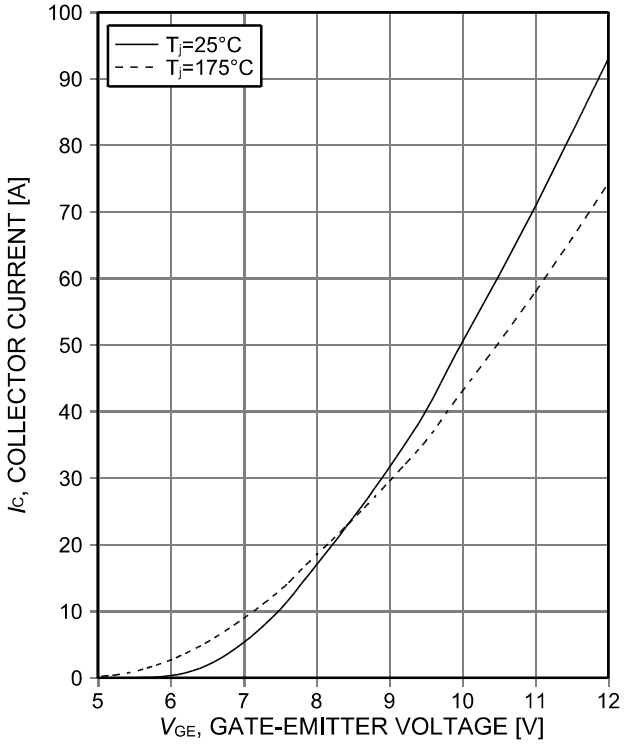

Figure 7. **Typical transfer characteristic**
(V_{CE}=20V)

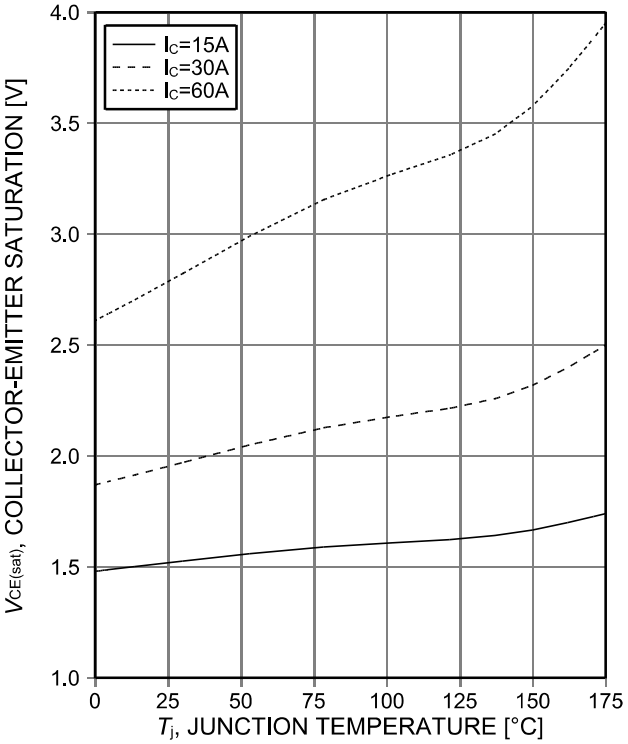

Figure 8. **Typical collector-emitter saturation voltage as a function of junction temperature**
(V_{GE}=15V)

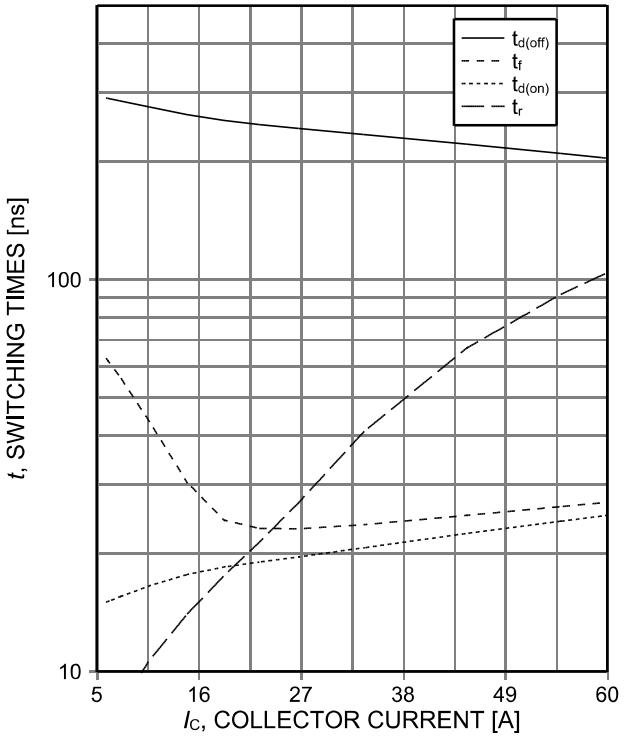

Figure 9. **Typical switching times as a function of collector current**
(ind. load, T_j=175°C, V_{CE}=400V, V_{GE}=15/0V, r_G=10,5Ω, test circuit in Fig. E)

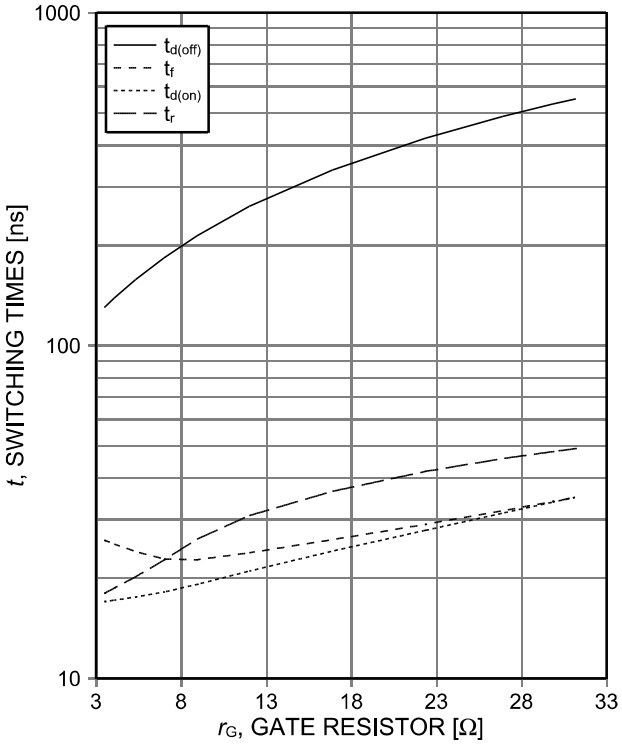

Figure 10. **Typical switching times as a function of gate resistor**
(ind. load, T_j=175°C, V_{CE}=400V, V_{GE}=15/0V, I_C=30A, test circuit in Fig. E)

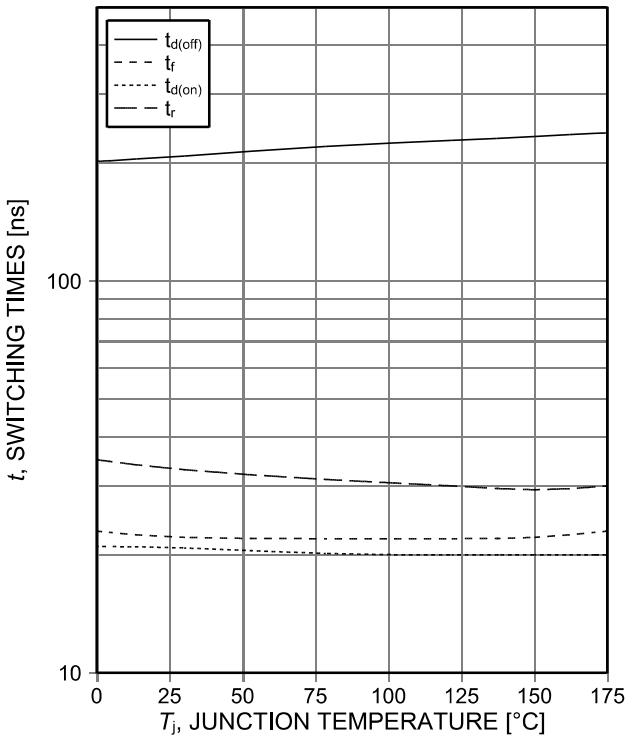

Figure 11. **Typical switching times as a function of junction temperature**
(ind. load, V_{CE}=400V, V_{GE}=15/0V, I_C=30A, r_G=10,5Ω, test circuit in Fig. E)

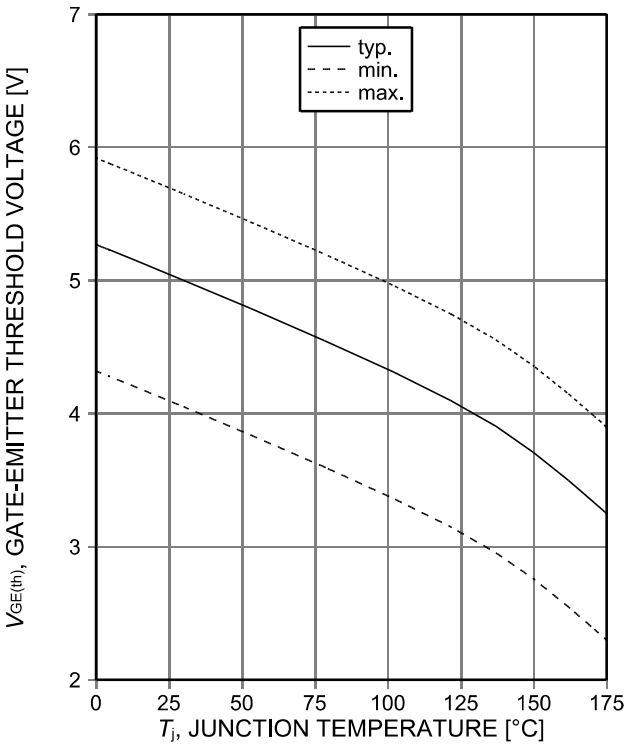

Figure 12. **Gate-emitter threshold voltage as a function of junction temperature**
(I_C=0.43mA)

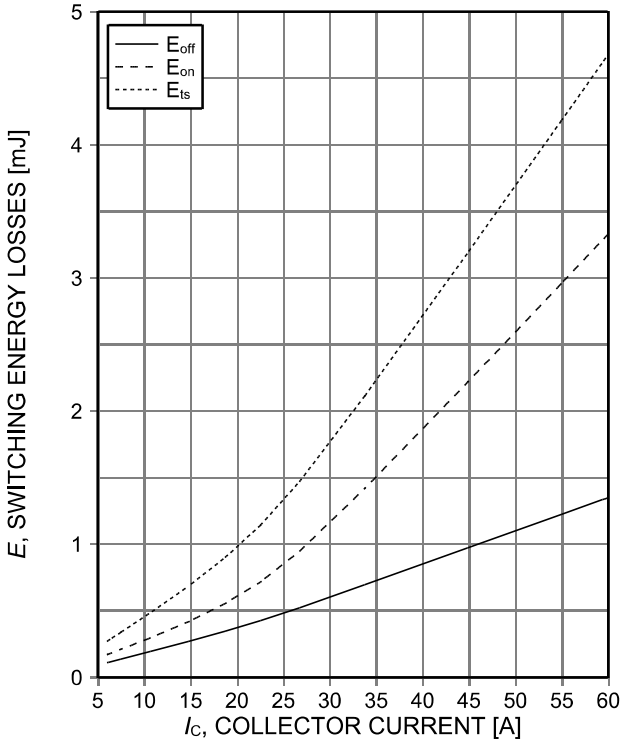

Figure 13. **Typical switching energy losses as a function of collector current**
(ind. load, T_j=175°C, V_{CE}=400V, V_{GE}=15/0V, r_G=10,5Ω, test circuit in Fig. E)

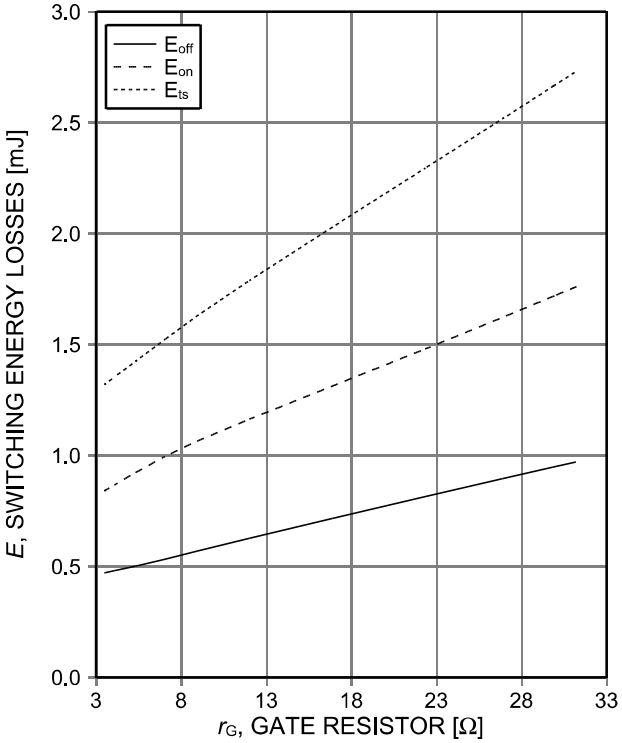

Figure 14. **Typical switching energy losses as a function of gate resistor**
(ind. load, T_j=175°C, V_{CE}=400V, V_{GE}=15/0V, I_C=30A, test circuit in Fig. E)

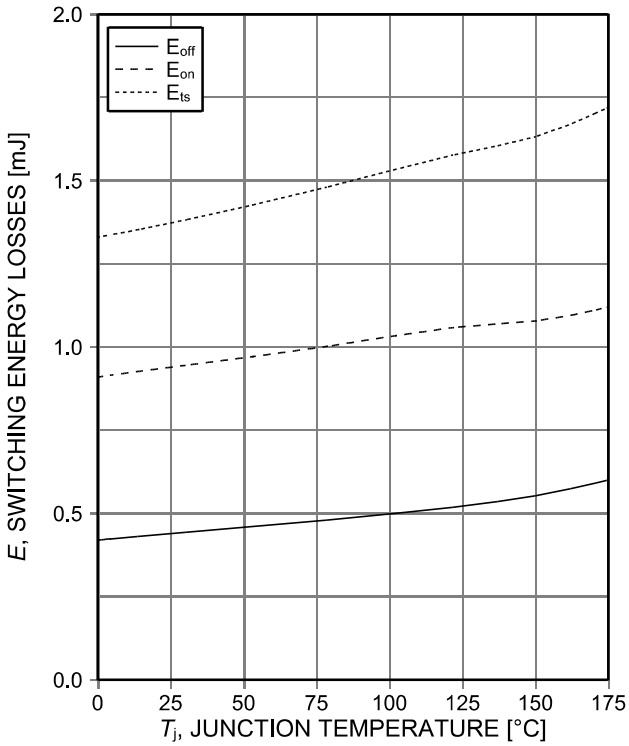

Figure 15. **Typical switching energy losses as a function of junction temperature**
(ind load, V_{CE}=400V, V_{GE}=15/0V, I_C=30A, r_G=10,5Ω, test circuit in Fig. E)

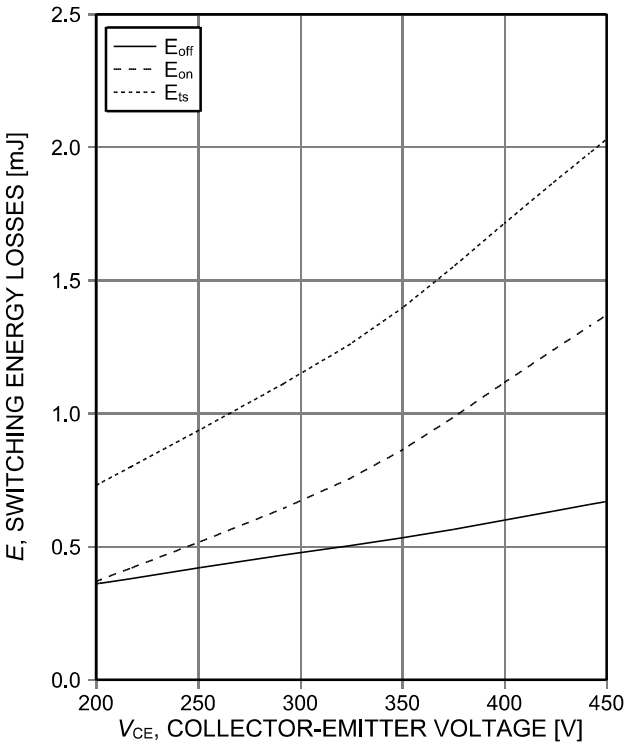

Figure 16. **Typical switching energy losses as a function of collector emitter voltage**
(ind. load, T_j=175°C, V_{GE}=15/0V, I_C=30A, r_G=10,5Ω, test circuit in Fig. E)