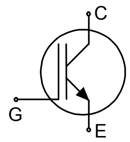
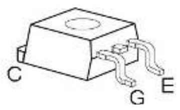
HighSpeed 2-Technology



- Designed for frequency inverters for washing machines, fans, pumps and vacuum cleaners
- **2nd generation HighSpeed-Technology for 1200V applications offers:**
  - loss reduction in resonant circuits
  - temperature stable behavior
  - parallel switching capability
  - tight parameter distribution
  - E_{off} optimized for I_C =3A
- Qualified according to JEDEC[2] for target applications
- Pb-free lead plating; RoHS compliant
- Complete product spectrum and PSpice Models : http://www.infineon.com/igbt/



PG-TO263-3-2

Type	V_{CE}	I_C	E_{off}	T_j	Marking	Package
IGB03N120H2	1200V	3A	0.15mJ	150°C	G03H1202	PG-TO263-3-2

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CE}	1200	V
Triangular collector current T_C = 25°C, f = 140kHz T_C = 100°C, f = 140kHz	I_C	 9.6 3.9	A
Pulsed collector current, t_p limited by T_{jmax}	I_{Cpuls}	9.9	
Turn off safe operating area $V_{CE} \le$ 1200V, $T_j \le$ 150°C	-	9.9	
Gate-emitter voltage	V_{GE}	±20	V
Power dissipation T_C = 25°C	P_{tot}	62.5	W
Operating junction and storage temperature	T_j , T_{stg}	-40...+150	°C
Soldering temperature (reflow soldering, MSL1)	-	245	

[2] J-STD-020 and JESD-022

Thermal Resistance

Parameter	Symbol	Conditions	Max. Value	Unit
Characteristic				
IGBT thermal resistance, junction – case	R_{thJC}		2.0	K/W
Thermal resistance, junction – ambient[1)]	R_{thJA}		40	

Electrical Characteristic, at T_j = 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=300µA	1200	-	-	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	V_{GE} = 15V, I_C=3A T_j=25°C T_j=150°C V_{GE} = 10V, I_C=3A, T_j=25°C	 - - -	 2.2 2.5 2.4	 2.8 - -	
Gate-emitter threshold voltage	$V_{GE(th)}$	I_C=90µA, V_{CE}=V_{GE}	2.1	3	3.9	
Zero gate voltage collector current	I_{CES}	V_{CE}=1200V, V_{GE}=0V T_j=25°C T_j=150°C	 - -	 - -	 20 80	µA
Gate-emitter leakage current	I_{GES}	V_{CE}=0V, V_{GE}=20V	-	-	100	nA
Transconductance	g_{fs}	V_{CE}=20V, I_C=3A	-	2	-	S
Dynamic Characteristic						
Input capacitance	C_{iss}	V_{CE}=25V,	-	205	-	pF
Output capacitance	C_{oss}	V_{GE}=0V,	-	24	-	
Reverse transfer capacitance	C_{rss}	f=1MHz	-	7	-	
Gate charge	Q_{Gate}	V_{CC}=960V, I_C=3A V_{GE}=15V	-	22	-	nC
Internal emitter inductance measured 5mm (0.197 in.) from case	L_E		-	7	-	nH

1) Device on 50mm*50mm*1.5mm epoxy PCB FR4 with 6cm^2 (one layer, 70µm thick) copper area for collector connection. PCB is vertical without blown air.

Switching Characteristic, Inductive Load, at T_j=25 °C

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
IGBT Characteristic						
Turn-on delay time	$t_{d(on)}$	T_j=25°C, V_{CC}=800V, I_C=3A, V_{GE}=15V/0V, R_G=82Ω, $L_σ$[2)]=180nH, $C_σ$[2)]=40pF Energy losses include "tail" and diode [4)] reverse recovery.	-	9.2	-	ns
Rise time	t_r		-	5.2	-	
Turn-off delay time	$t_{d(off)}$		-	281	-	
Fall time	t_f		-	29	-	
Turn-on energy	E_{on}		-	0.14	-	mJ
Turn-off energy	E_{off}		-	0.15	-	
Total switching energy	E_{ts}		-	0.29	-	

Switching Characteristic, Inductive Load, at T_j=150 °C

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
IGBT Characteristic						
Turn-on delay time	$t_{d(on)}$	T_j=150°C V_{CC}=800V, I_C=3A, V_{GE}=15V/0V, R_G=82Ω, $L_σ$[2)]=180nH, $C_σ$[2)]=40pF Energy losses include "tail" and diode [3)] reverse recovery.	-	9.4	-	ns
Rise time	t_r		-	6.7	-	
Turn-off delay time	$t_{d(off)}$		-	340	-	
Fall time	t_f		-	63	-	
Turn-on energy	E_{on}		-	0.22	-	mJ
Turn-off energy	E_{off}		-	0.26	-	
Total switching energy	E_{ts}		-	0.48	-	

Switching Energy ZVT, Inductive Load

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
IGBT Characteristic						
Turn-off energy	E_{off}	V_{CC}=800V, I_C=3A, V_{GE}=15V/0V, R_G=82Ω, C_r[2)]=4nF				mJ
		T_j=25°C	-	0.05	-	
		T_j=150°C	-	0.09	-	

[2)] Leakage inductance $L_σ$ and stray capacity $C_σ$ due to dynamic test circuit in figure E
[4)] Commutation diode from device IKP03N120H2

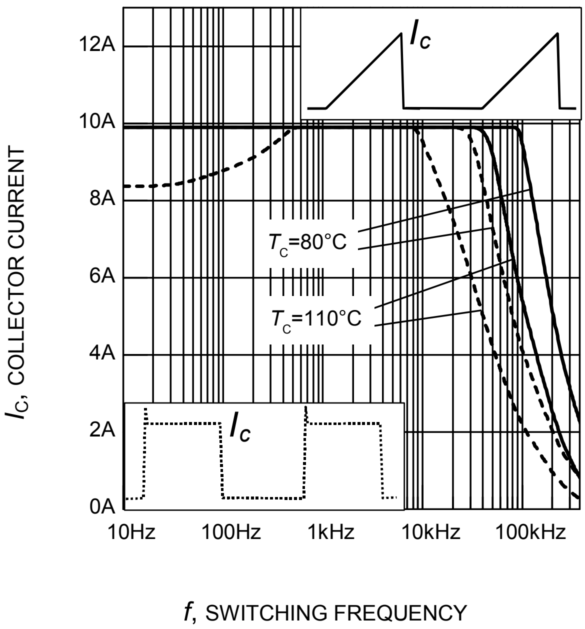


Figure 1. Collector current as a function of switching frequency
($T_j \leq 150°C$, $D = 0.5$, $V_{CE} = 800V$, $V_{GE} = +15V/0V$, $R_G = 82\Omega$)

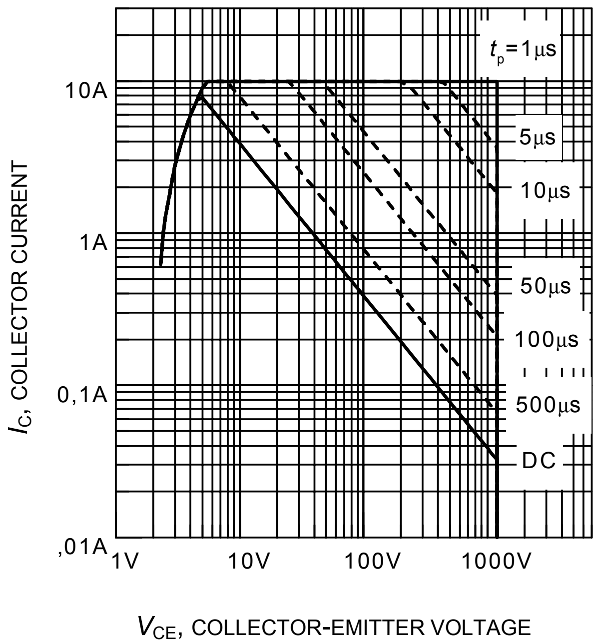


Figure 2. Safe operating area
($D = 0$, $T_C = 25°C$, $T_j \leq 150°C$)

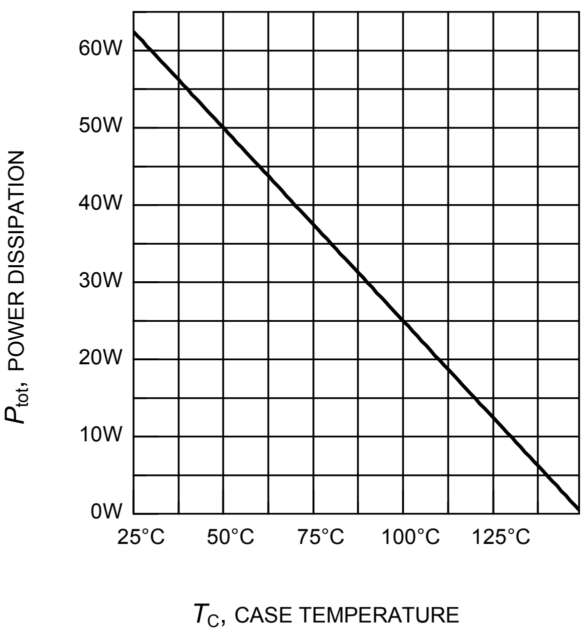


Figure 3. Power dissipation as a function of case temperature
($T_j \leq 150°C$)

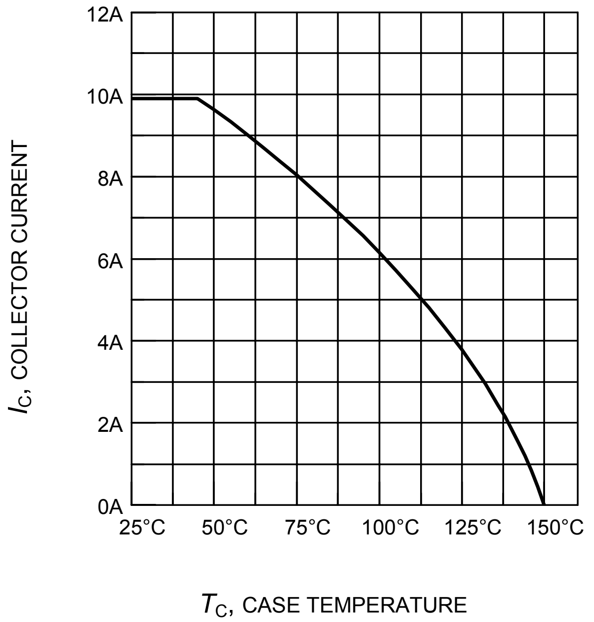


Figure 4. Collector current as a function of case temperature
($V_{GE} \leq 15V$, $T_j \leq 150°C$)

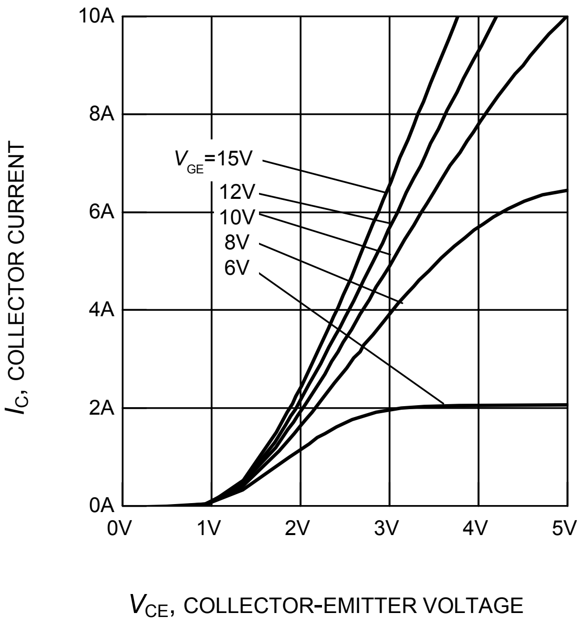


Figure 5. Typical output characteristics
(T_j = 25°C)

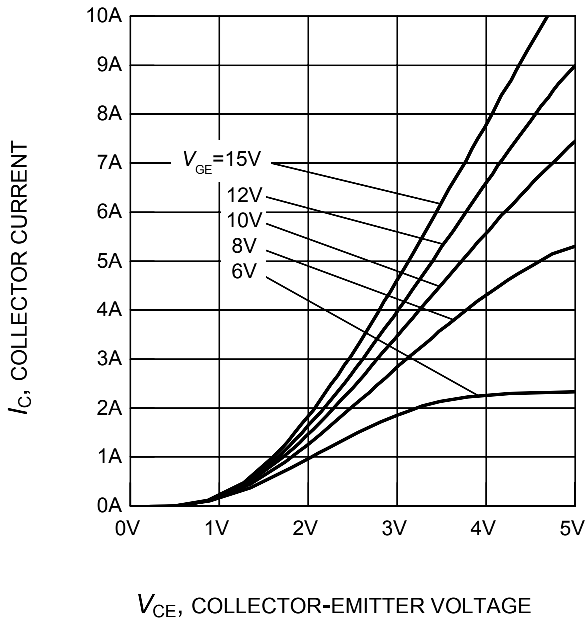


Figure 6. Typical output characteristics
(T_j = 150°C)

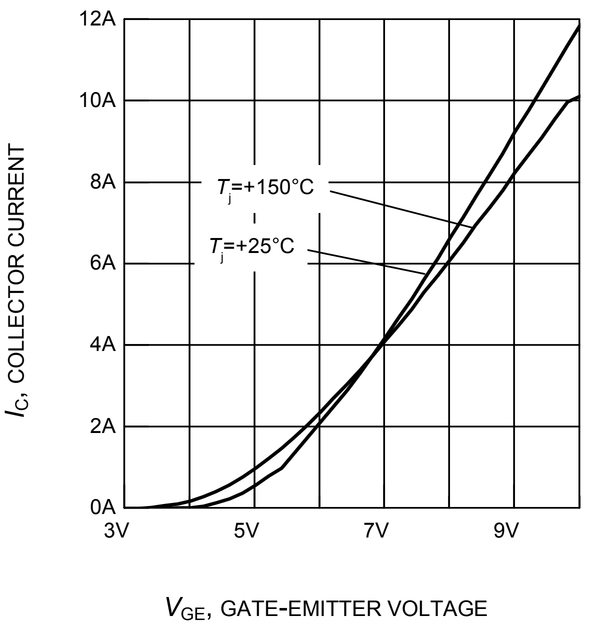


Figure 7. Typical transfer characteristics
(V_{CE} = 20V)

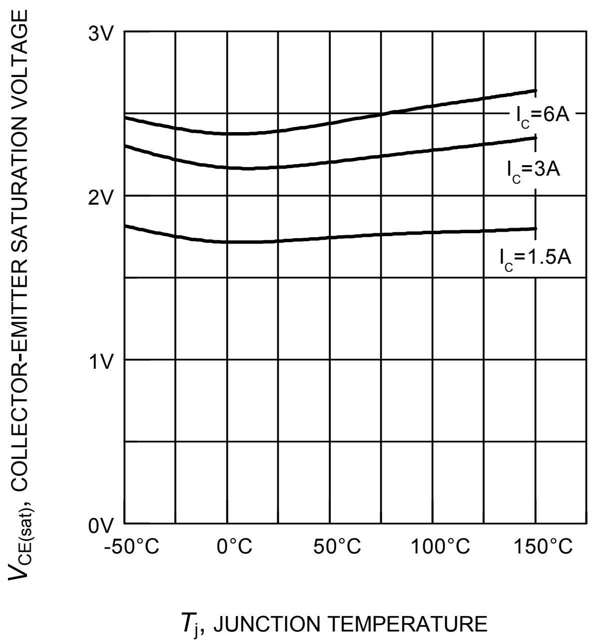


Figure 8. Typical collector-emitter saturation voltage as a function of junction temperature
(V_{GE} = 15V)

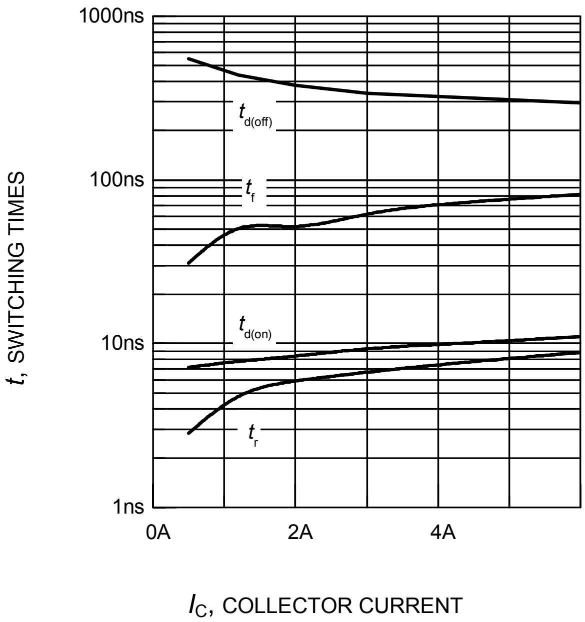


Figure 9. Typical switching times as a function of collector current
(inductive load, T_j = 150°C,
V_{CE} = 800V, V_{GE} = +15V/0V, R_G = 82Ω,
dynamic test circuit in Fig.E)

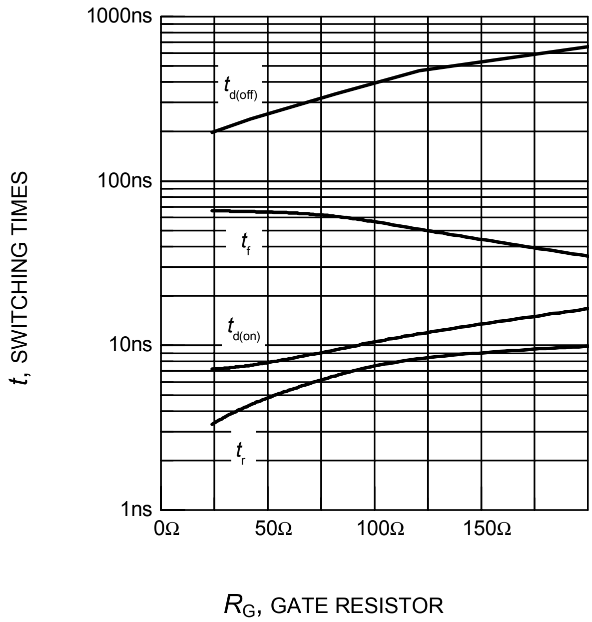


Figure 10. Typical switching times as a function of gate resistor
(inductive load, T_j = 150°C,
V_{CE} = 800V, V_{GE} = +15V/0V, I_C = 3A,
dynamic test circuit in Fig.E)

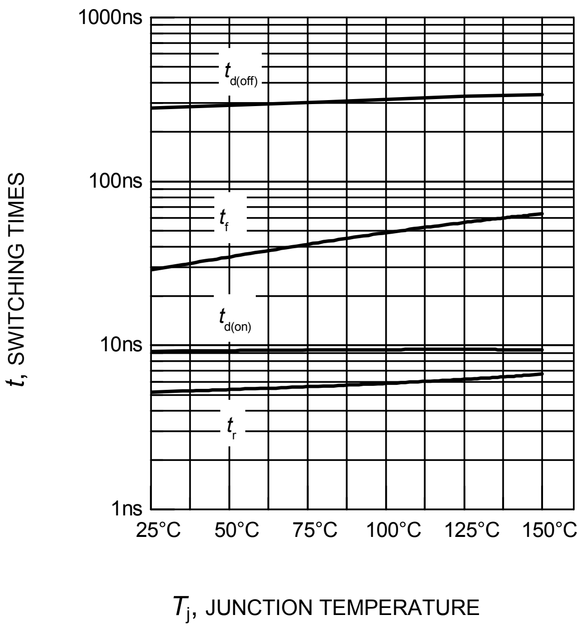


Figure 11. Typical switching times as a function of junction temperature
(inductive load, V_{CE} = 800V,
V_{GE} = +15V/0V, I_C = 3A, R_G = 82Ω,
dynamic test circuit in Fig.E)

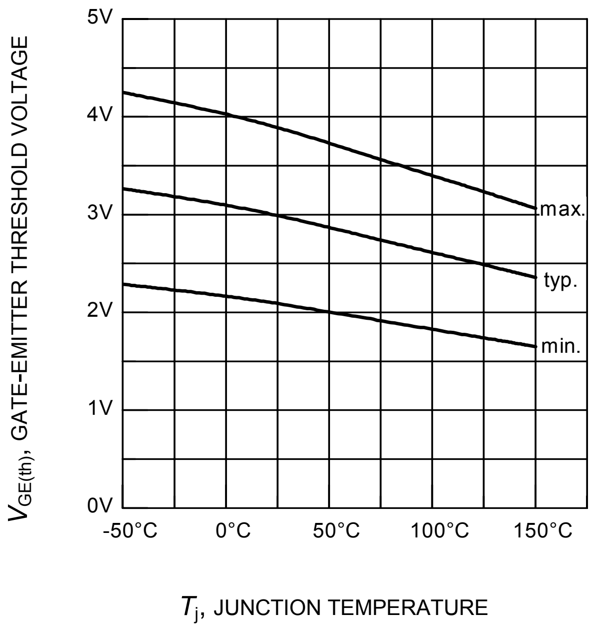


Figure 12. Gate-emitter threshold voltage as a function of junction temperature
(I_C = 0.09mA)

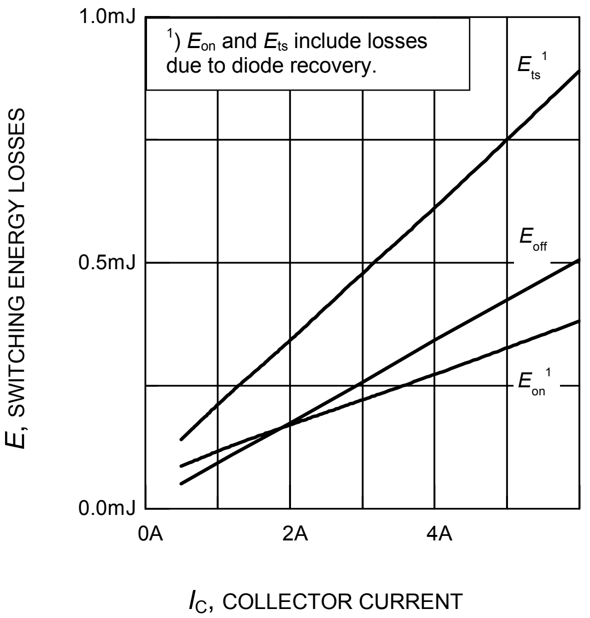


Figure 13. Typical switching energy losses as a function of collector current
(inductive load, T_j = 150°C, V_{CE} = 800V, V_{GE} = +15V/0V, R_G = 82Ω, dynamic test circuit in Fig.E)

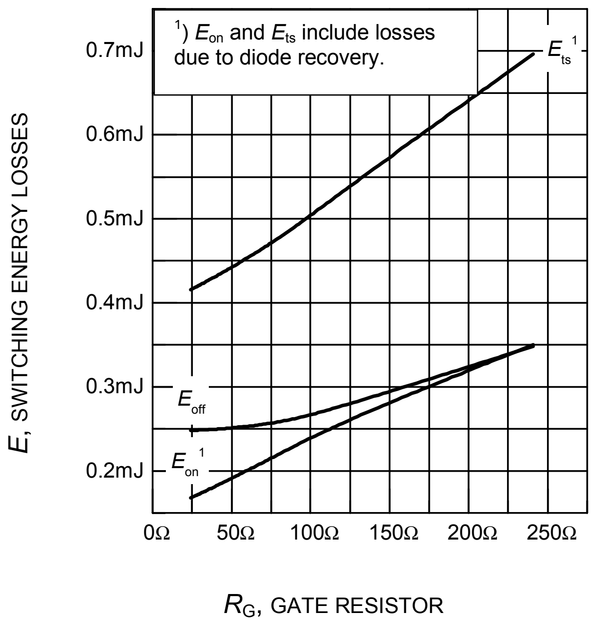


Figure 14. Typical switching energy losses as a function of gate resistor
(inductive load, T_j = 150°C, V_{CE} = 800V, V_{GE} = +15V/0V, I_C = 3A, dynamic test circuit in Fig.E)

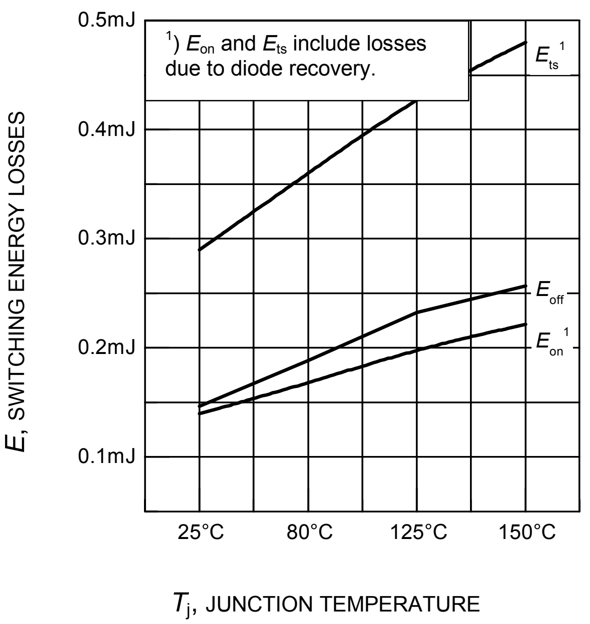


Figure 15. Typical switching energy losses as a function of junction temperature
(inductive load, V_{CE} = 800V, V_{GE} = +15V/0V, I_C = 3A, R_G = 82Ω, dynamic test circuit in Fig.E)

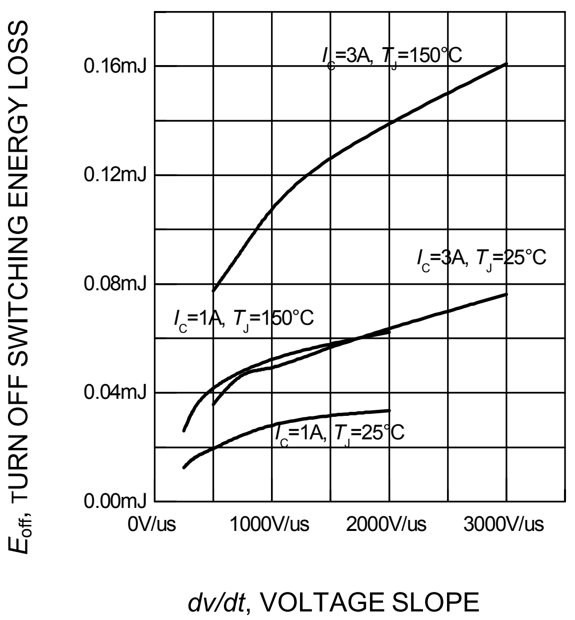
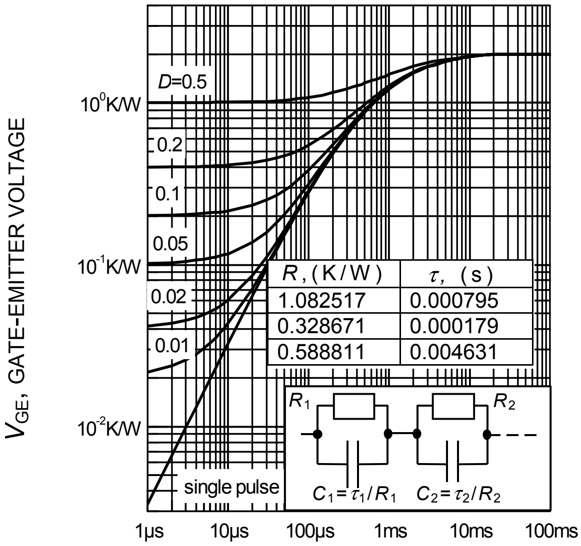
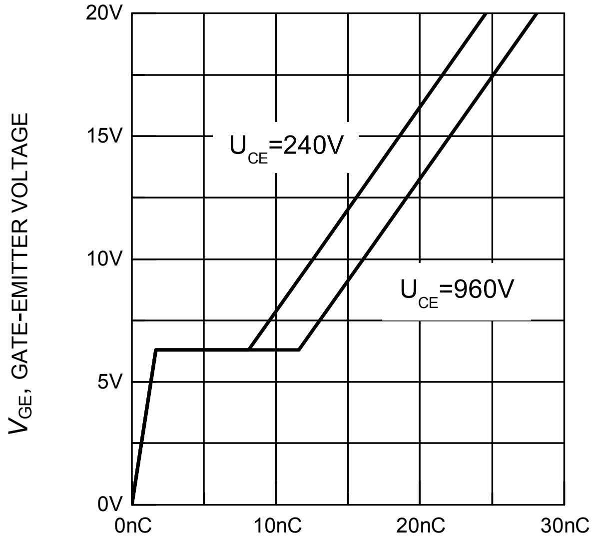


Figure 16. Typical turn off switching energy loss for soft switching
(*dynamic test circuit in Fig. E*)



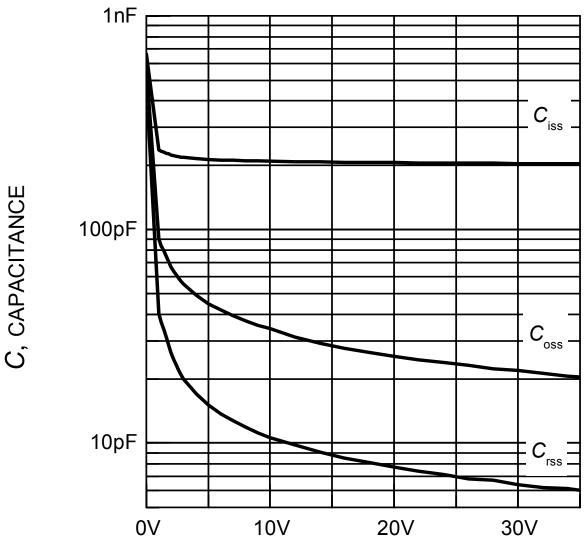
Q_{GE}, GATE CHARGE

Figure 17. Typical gate charge
(I_C = 3A)



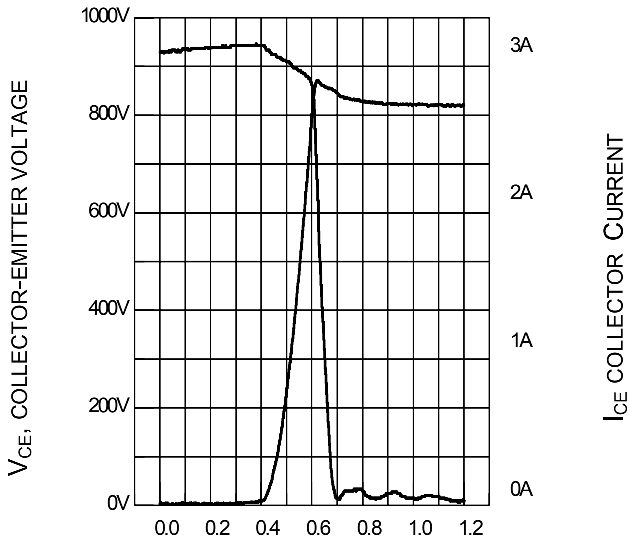
Q_{GE}, GATE CHARGE

Figure 17. Typical gate charge
(I_C = 3A)



V_{CE}, COLLECTOR-EMITTER VOLTAGE

Figure 18. Typical capacitance as a function of collector-emitter voltage
(V_{GE} = 0V, f = 1MHz)



t_p, PULSE WIDTH

Figure 20. Typical turn off behavior, hard switching
(V_{GE}=15/0V, R_G=82Ω, T_j = 150°C, Dynamic test circuit in Figure E)

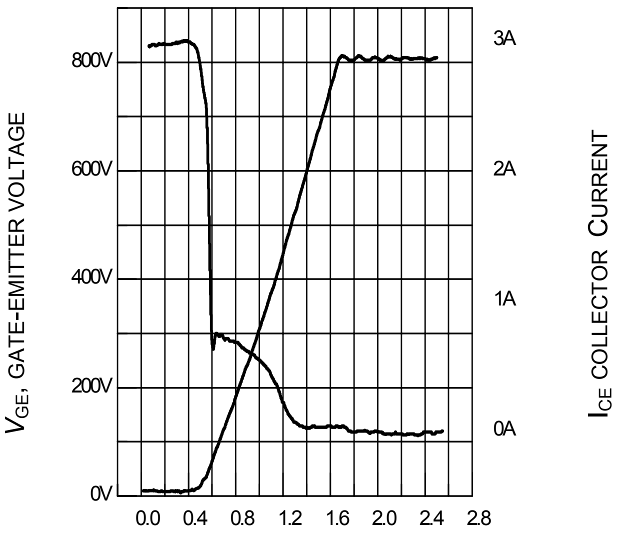


Figure 21. Typical turn off behavior, soft switching
(V_{GE}=15/0V, R_G=82Ω, T_j = 150°C, Dynamic test circuit in Figure E)

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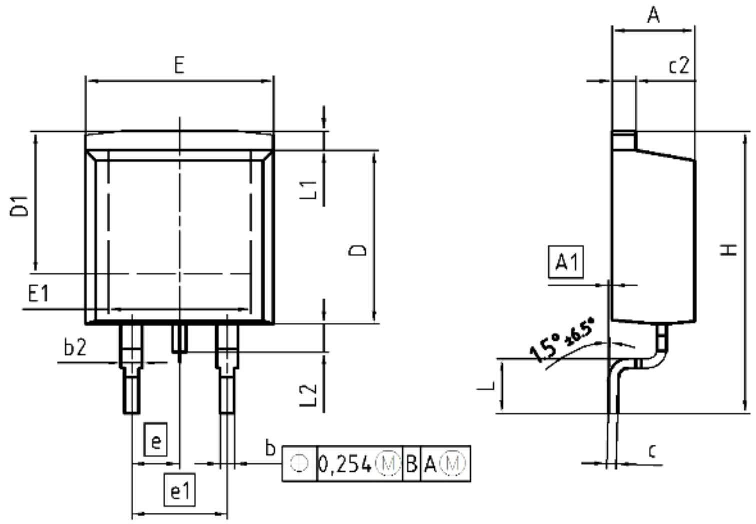

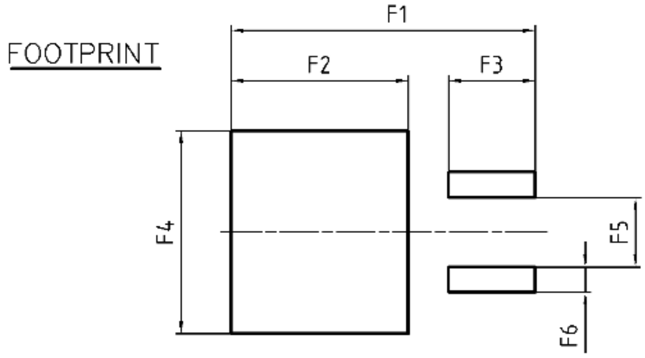

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.30	4.57	0.169	0.180
A1	0.00	0.25	0.000	0.010
b	0.65	0.85	0.026	0.033
b2	0.95	1.15	0.037	0.045
c	0.33	0.65	0.013	0.026
c2	1.17	1.40	0.046	0.055
D	8.51	9.45	0.335	0.372
D1	7.10	7.90	0.280	0.311
E	9.80	10.31	0.386	0.406
E1	6.50	8.60	0.256	0.339
e	2.54		0.100	
e1	5.08		0.200	
N	2		2	
H	14.61	15.88	0.575	0.625
L	2.29	3.00	0.090	0.118
L1	0.70	1.60	0.028	0.063
L2	1.00	1.78	0.039	0.070
F1	16.05	16.25	0.632	0.640
F2	9.30	9.50	0.366	0.374
F3	4.50	4.70	0.177	0.185
F4	10.70	10.90	0.421	0.429
F5	3.65	3.85	0.144	0.152
F6	1.25	1.45	0.049	0.057

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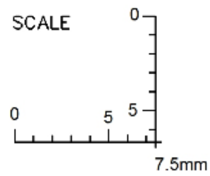
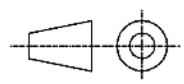
SCALE



EUROPEAN PROJECTION



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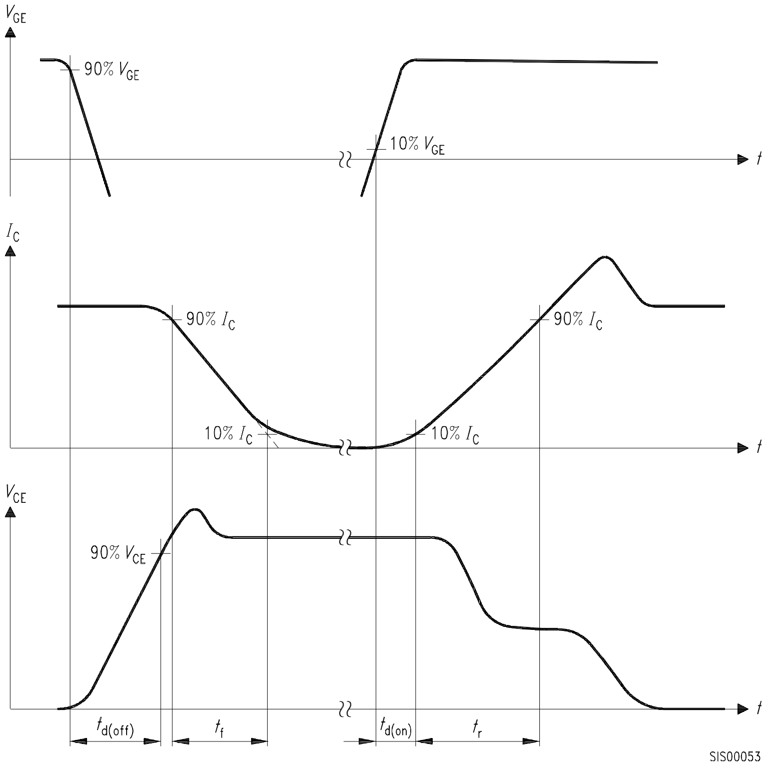

Figure A. Definition of switching times

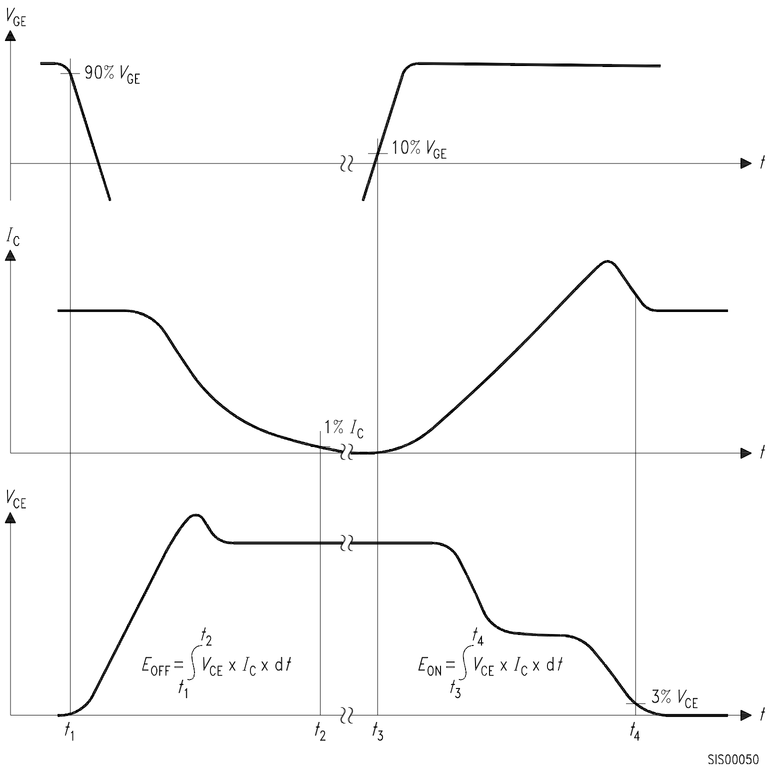

Figure B. Definition of switching losses

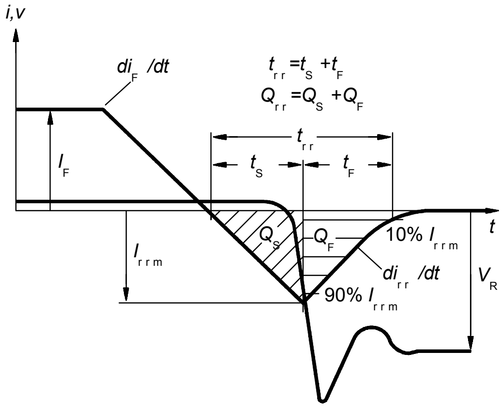

Figure C. Definition of diodes switching characteristics

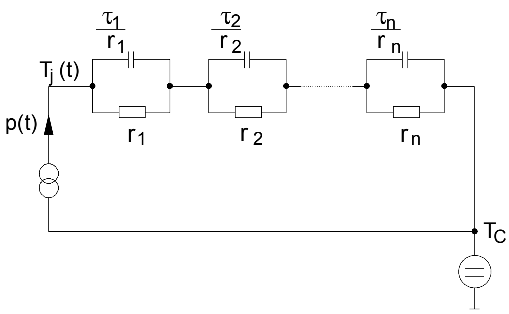

Figure D. Thermal equivalent circuit

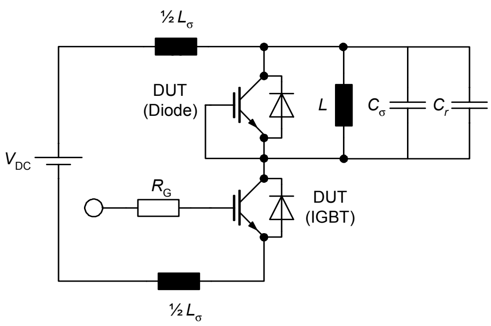

Figure E. Dynamic test circuit
Leakage inductance L_σ= 180nH,
Stray capacitor C_σ = 40pF,
Relief capacitor C_r = 4nF (only for ZVT switching)

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