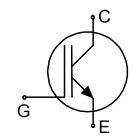
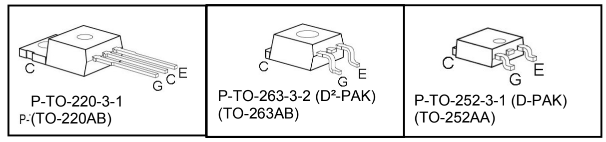
HighSpeed 2-Technology

- **Designed for:**
  - SMPS
  - Lamp Ballast
  - ZVS-Converter
  - optimised for soft-switching / resonant topologies



- **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 =1A



- Complete product spectrum and PSpice Models : http://www.infineon.com/igbt/

Type	V_{CE}	I_C	E_{off}	T_j	Package	Ordering Code
IGP01N120H2	1200V	1A	0.09mJ	150°C	P-TO-220-3-1	Q67040-S4593
IGB01N120H2	1200V	1A	0.09mJ	150°C	P-TO-263 (D^2PAK)	Q67040-S4592
IGD01N120H2	1200V	1A	0.09mJ	150°C	P-TO-252 (DPAK)	Q67040-S4591

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	 3.2 1.3	A
Pulsed collector current, t_p limited by T_{jmax}	I_{Cpuls}	3.5	
Turn off safe operating area $V_{CE} \leq$ 1200V, $T_j \leq$ 150°C	-	3.5	
Gate-emitter voltage	V_{GE}	±20	V
Power dissipation T_C = 25°C	P_{tot}	28	W
Operating junction and storage temperature	T_j , T_{stg}	-40...+150	°C
Soldering temperature, 1.6mm (0.063 in.) from case for 10s	-	260 225 (for SMD)	

Thermal Resistance

Parameter	Symbol	Conditions	Max. Value	Unit
Characteristic				
IGBT thermal resistance, junction – case	R_{thJC}		4.5	K/W
Thermal resistance, junction – ambient	R_{thJA}	P-TO-220-3-1	62	
SMD version, device on PCB[1)]	R_{thJA}	P-TO-263 (D^2PAK)	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=1A				
		T_j=25°C	-	2.2	2.8	
		T_j=150°C	-	2.5	-	
		V_{GE} = 10V, I_C=1A, T_j=25°C	-	2.4	-	
Gate-emitter threshold voltage	$V_{GE(th)}$	I_C=30µA, V_{CE}=V_{GE}	2.1	3	3.9	
Zero gate voltage collector current	I_{CES}	V_{CE}=1200V, V_{GE}=0V				µA
		T_j=25°C	-	-	20	
		T_j=150°C	-	-	80	
Gate-emitter leakage current	I_{GES}	V_{CE}=0V, V_{GE}=20V	-	-	40	nA
Transconductance	g_{fs}	V_{CE}=20V, I_C=1A	-	0.75	-	S
Dynamic Characteristic						
Input capacitance	C_{iss}	V_{CE}=25V,	-	91.6	-	pF
Output capacitance	C_{oss}	V_{GE}=0V,	-	9.8	-	
Reverse transfer capacitance	C_{rss}	f=1MHz	-	3.4	-	
Gate charge	Q_{Gate}	V_{CC}=960V, I_C=1A V_{GE}=15V	-	8.6	-	nC
Internal emitter inductance measured 5mm (0.197 in.) from case	L_E	P-TO-220-3-1	-	7	-	nH
		P-TO-247-3-1		13		

[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,	-	13	-	ns
Rise time	t_r	V_{CC}=800V,	-	6.3	-	
Turn-off delay time	$t_{d(off)}$	I_C=1A,	-	370	-	
Fall time	t_f	V_{GE}=15V/0V,	-	28	-	
Turn-on energy	E_{on}	R_G=241Ω, L_σ[2)]=180nH,	-	0.08	-	mJ
Turn-off energy	E_{off}	C_σ[2)]=40pF	-	0.06	-	
Total switching energy	E_{ts}	Energy losses include "tail" and diode [3)] reverse recovery.	-	0.14	-	

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	-	12	-	ns
Rise time	t_r	V_{CC}=800V,	-	8.9	-	
Turn-off delay time	$t_{d(off)}$	I_C=1A,	-	450	-	
Fall time	t_f	V_{GE}=15V/0V,	-	43	-	
Turn-on energy	E_{on}	R_G=241Ω, L_σ[2)]=180nH,	-	0.11	-	mJ
Turn-off energy	E_{off}	C_σ[2)]=40pF	-	0.09	-	
Total switching energy	E_{ts}	Energy losses include "tail" and diode [3)] reverse recovery.	-	0.2	-	

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=1A, V_{GE}=15V/0V, R_G=241Ω, C_r[2)]=1nF				mJ
		T_j=25°C	-	0.02	-	
		T_j=150°C	-	0.044	-	

[2)] Leakage inductance L_σ and stray capacity C_σ due to dynamic test circuit in figure E
[3)] Commutation diode from device IKP01N120H2

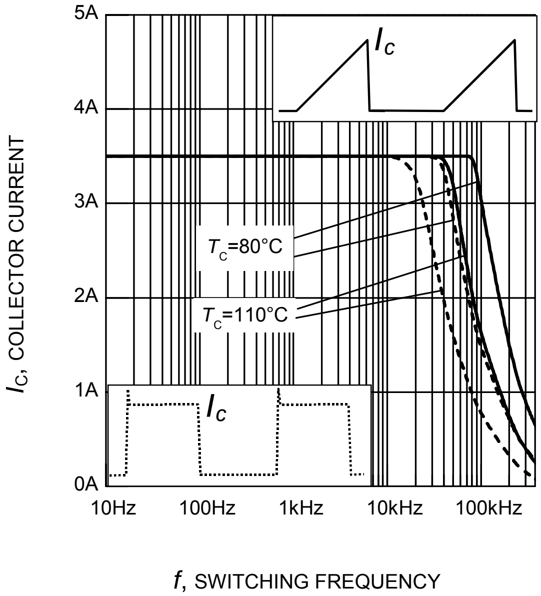


Figure 1. Collector current as a function of switching frequency
($T_j \leq 150°C$, $D = 0.5$, $V_{CE} = 800V$, $V_{GE} = +15V/0V$, $R_G = 241\Omega$)

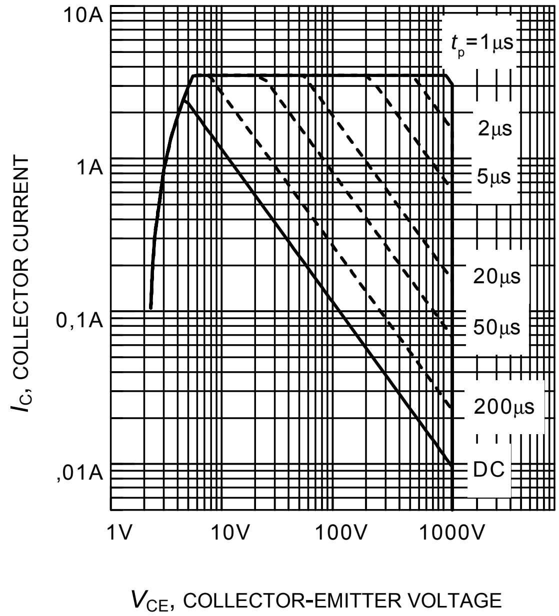


Figure 2. Safe operating area
($D = 0$, $T_C = 25°C$, $T_j \leq 150°C$)

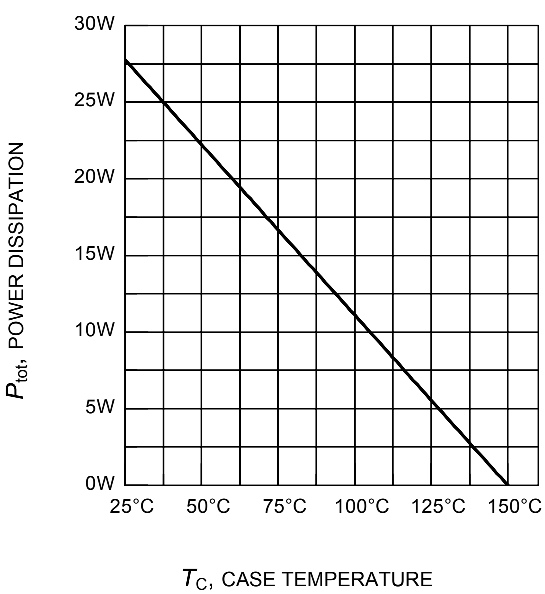


Figure 3. Power dissipation as a function of case temperature
($T_j \leq 150°C$)

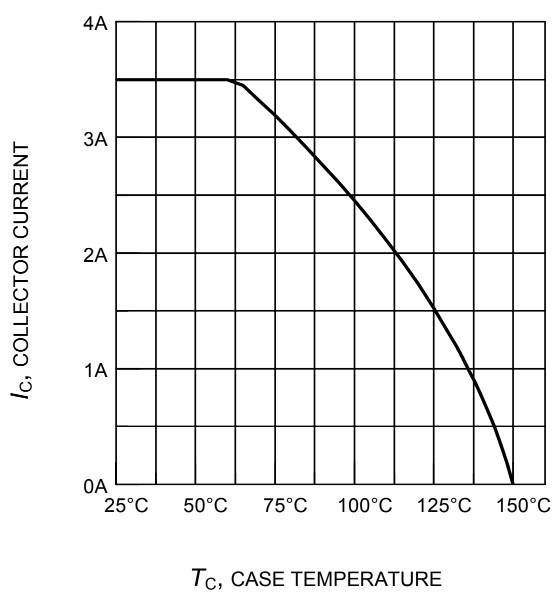


Figure 4. Collector current as a function of case temperature
($V_{GE} \leq 15V$, $T_j \leq 150°C$)

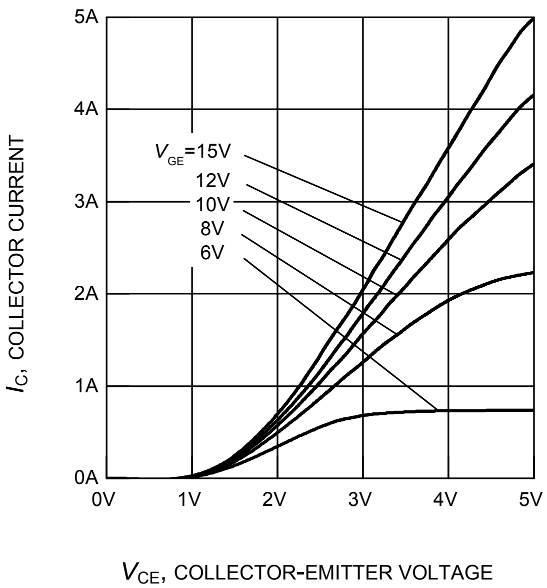


Figure 5. Typical output characteristics
(T_j = 25°C)

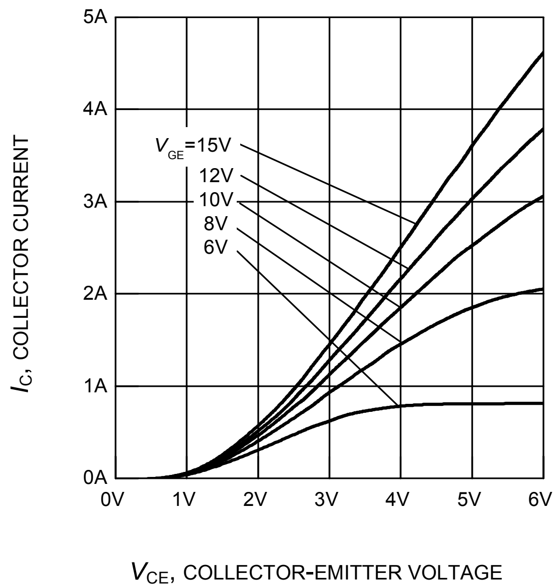


Figure 6. Typical output characteristics
(T_j = 150°C)

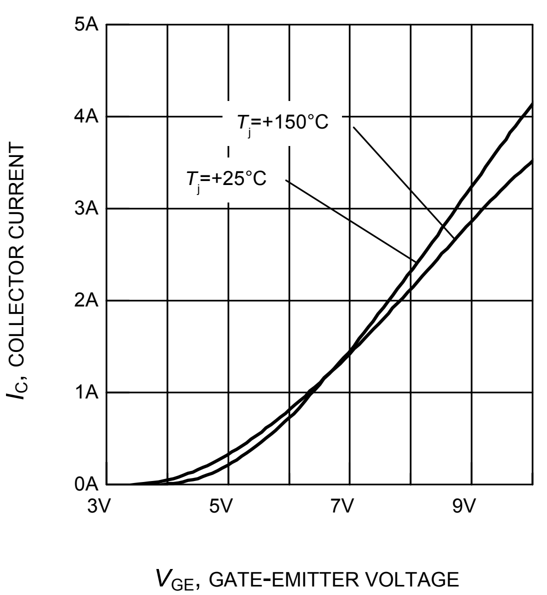


Figure 7. Typical transfer characteristics
(V_{CE} = 20V)

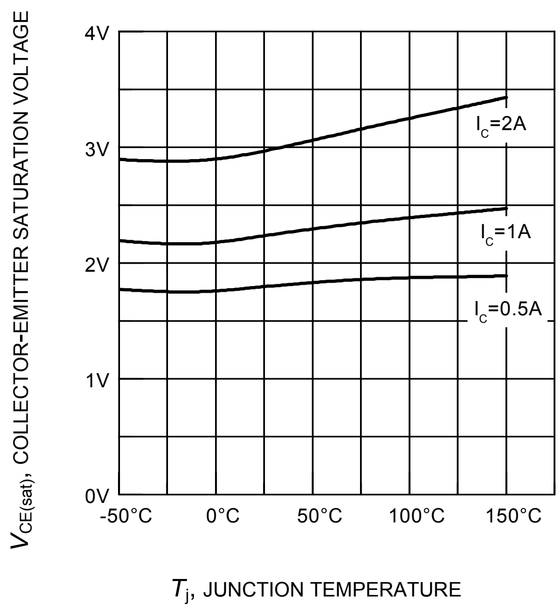


Figure 8. Typical collector-emitter saturation voltage as a function of junction temperature
(V_{GE} = 15V)

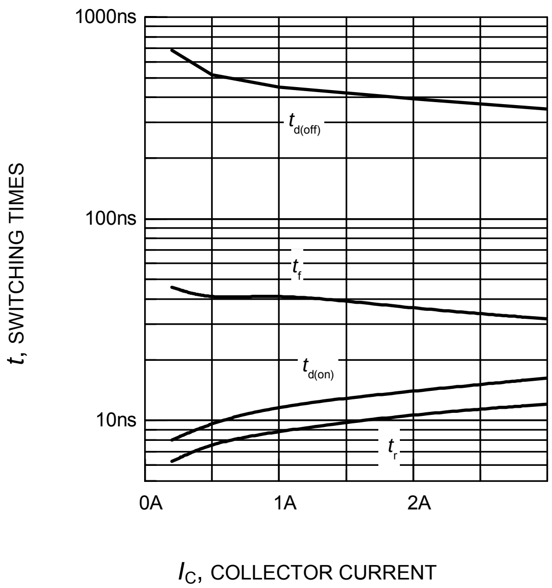


Figure 9. Typical switching times as a function of collector current
(inductive load, T_j = 150°C, V_{CE} = 800V, V_{GE} = +15V/0V, R_G = 241Ω, dynamic test circuit in Fig.E)

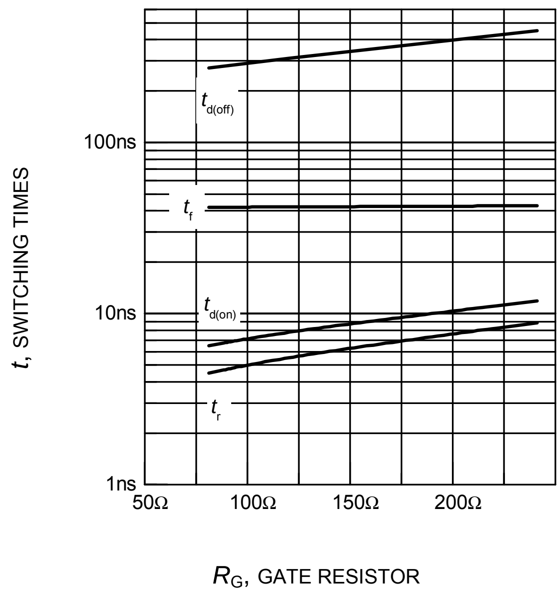


Figure 10. Typical switching times as a function of gate resistor
(inductive load, T_j = 150°C, V_{CE} = 800V, V_{GE} = +15V/0V, I_C = 1A, dynamic test circuit in Fig.E)

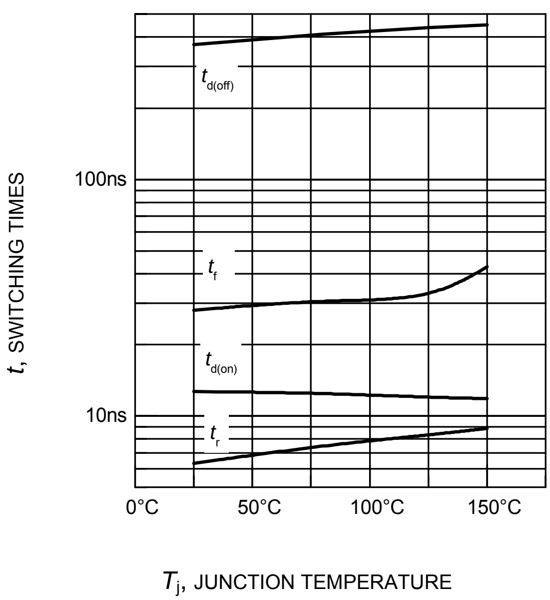


Figure 11. Typical switching times as a function of junction temperature
(inductive load, V_{CE} = 800V, V_{GE} = +15V/0V, I_C = 1A, R_G = 241Ω, dynamic test circuit in Fig.E)

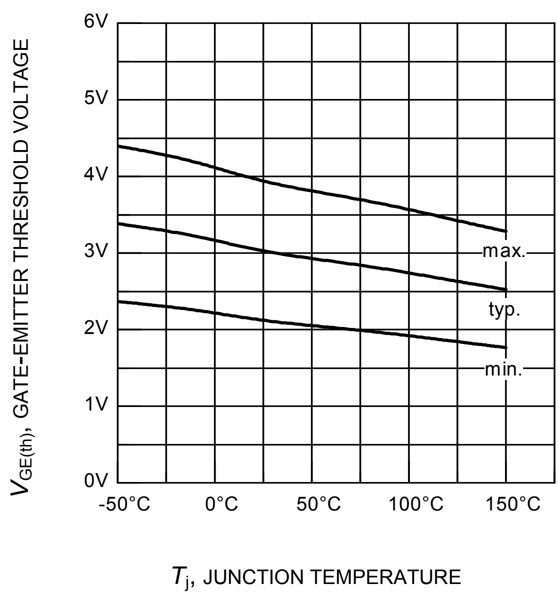


Figure 12. Gate-emitter threshold voltage as a function of junction temperature
(I_C = 0.03mA)

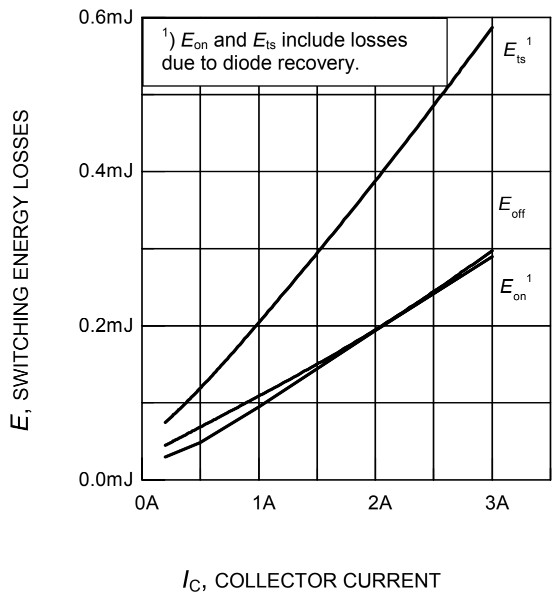


Figure 13. Typical switching energy losses as a function of collector current
(inductive load, T_j = 150°C,
V_{CE} = 800V, V_{GE} = +15V/0V, R_G = 241Ω,
dynamic test circuit in Fig.E)

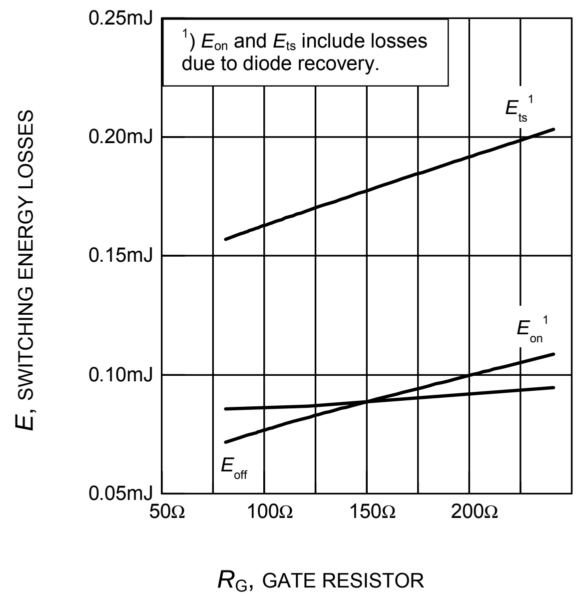


Figure 14. Typical switching energy losses as a function of gate resistor
(inductive load, T_j = 150°C,
V_{CE} = 800V, V_{GE} = +15V/0V, I_C = 1A,
dynamic test circuit in Fig.E)

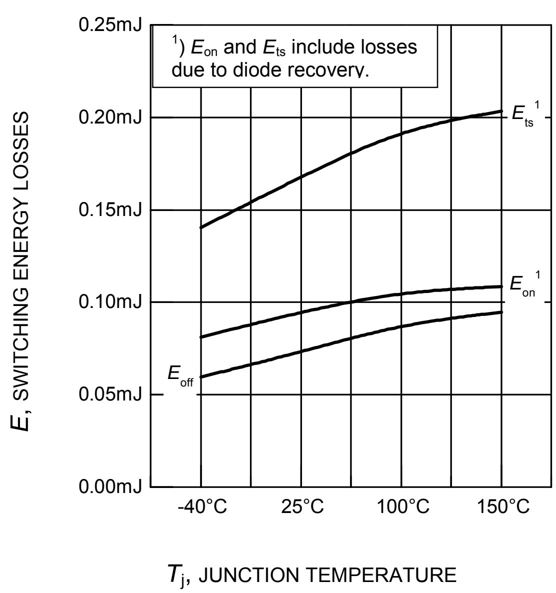


Figure 15. Typical switching energy losses as a function of junction temperature
(inductive load, V_{CE} = 800V,
V_{GE} = +15V/0V, I_C = 1A, R_G = 241Ω,
dynamic test circuit in Fig.E)

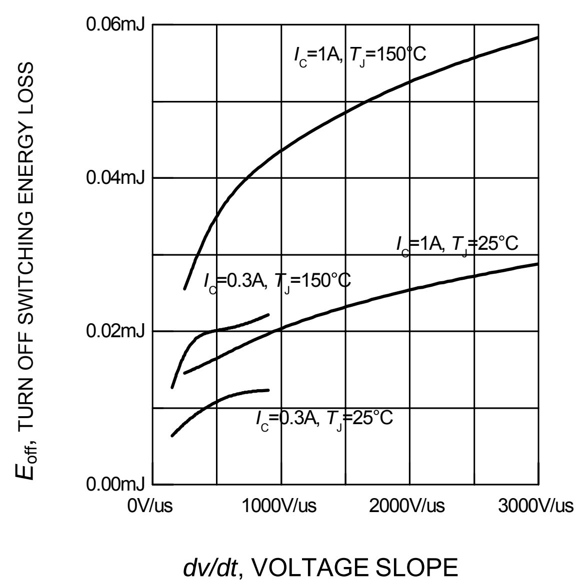


Figure 16. Typical turn off switching energy loss for soft switching
(*dynamic test circuit in Fig. E*)

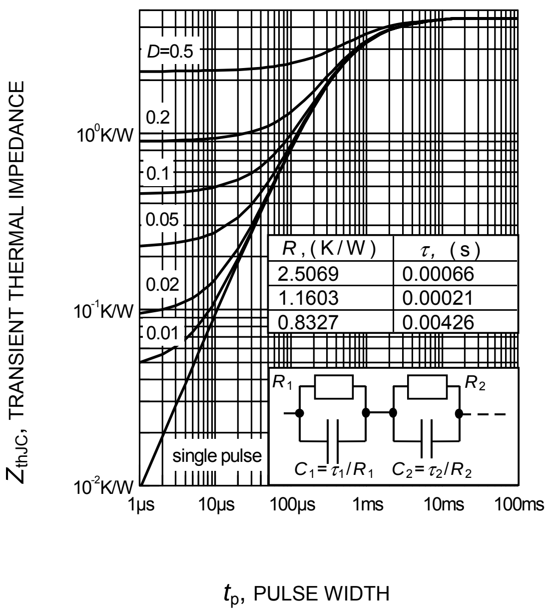


Figure 17. IGBT transient thermal impedance as a function of pulse width
($D = t_p / T$)

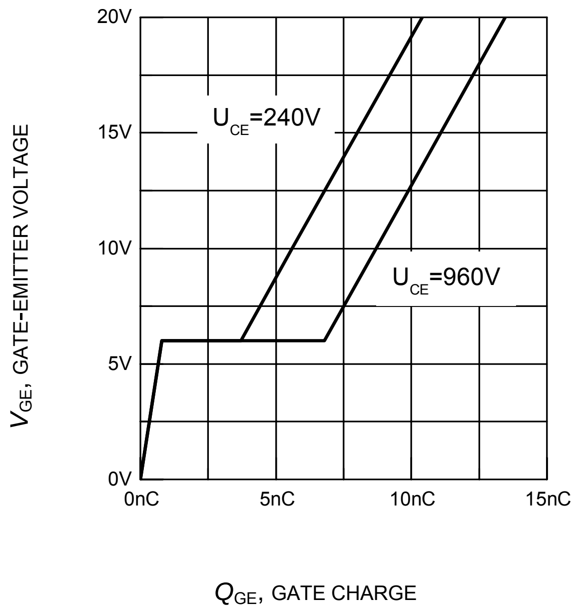


Figure 18. Typical gate charge
(I_C = 1A)

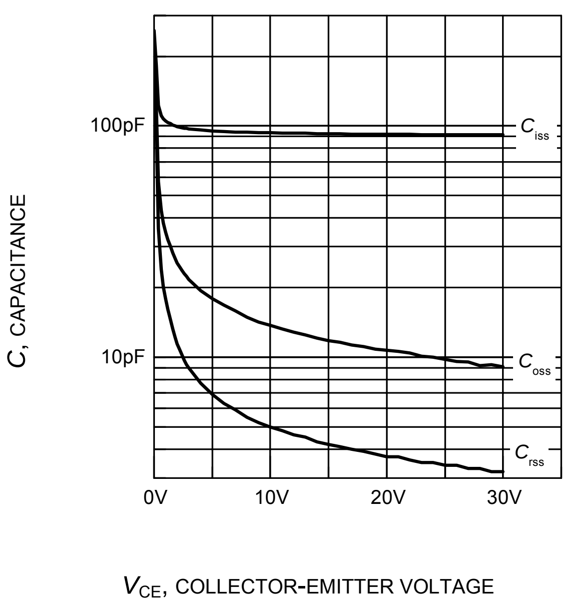


Figure 19. Typical capacitance as a function of collector-emitter voltage
(V_{GE} = 0V, f = 1MHz)

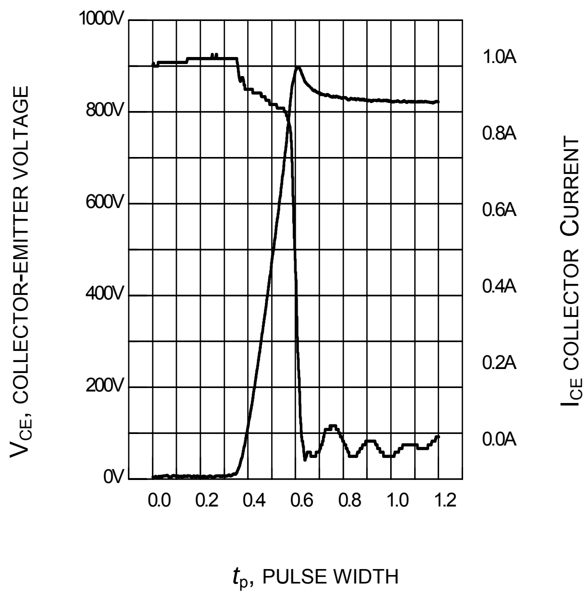


Figure 20. Typical turn off behavior, hard switching
(V_{GE}=15/0V, R_G=220Ω, T_j = 150°C, Dynamic test circuit in Figure E)

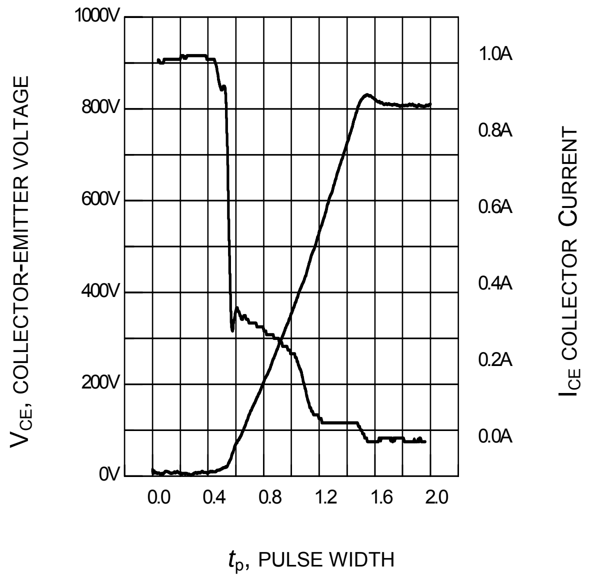
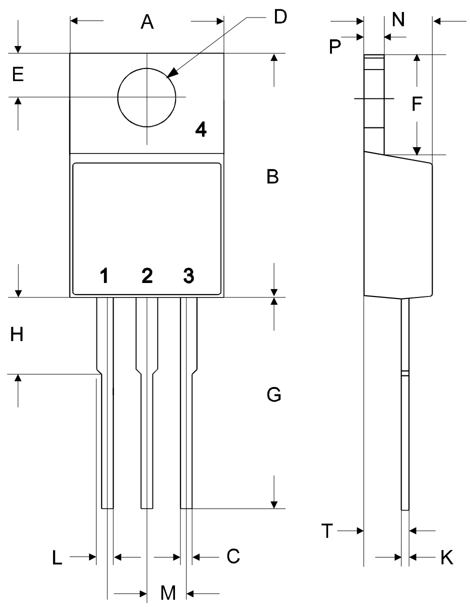


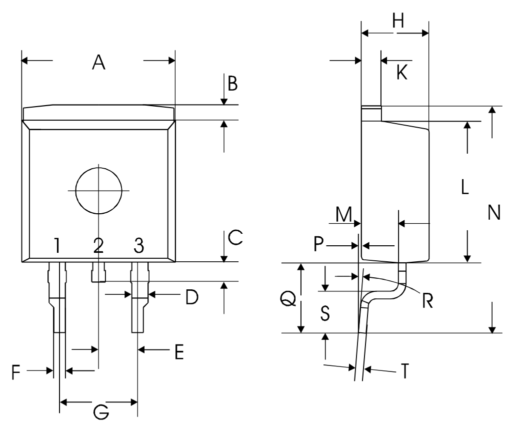
Figure 21. Typical turn off behavior, soft switching
(V_{GE}=15/0V, R_G=220Ω, T_j = 150°C, Dynamic test circuit in Figure E)

TO-220AB

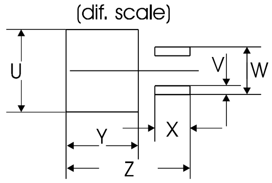


symbol	dimensions			
	[mm]		[inch]	
	min	max	min	max
A	9.70	10.30	0.3819	0.4055
B	14.88	15.95	0.5858	0.6280
C	0.65	0.86	0.0256	0.0339
D	3.55	3.89	0.1398	0.1531
E	2.60	3.00	0.1024	0.1181
F	6.00	6.80	0.2362	0.2677
G	13.00	14.00	0.5118	0.5512
H	4.35	4.75	0.1713	0.1870
K	0.38	0.65	0.0150	0.0256
L	0.95	1.32	0.0374	0.0520
M	2.54 typ.		0.1 typ.	
N	4.30	4.50	0.1693	0.1772
P	1.17	1.40	0.0461	0.0551
T	2.30	2.72	0.0906	0.1071

TO-263AB (D²Pak)

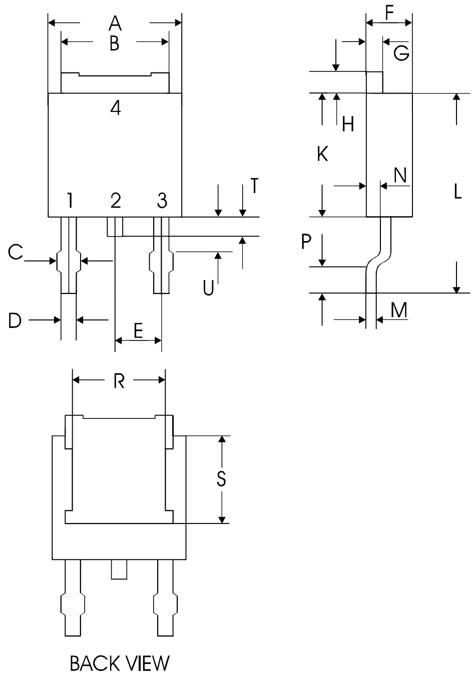


Footprint
(dif. scale)



symbol	dimensions			
	[mm]		[inch]	
	min	max	min	max
A	9.80	10.20	0.3858	0.4016
B	0.70	1.30	0.0276	0.0512
C	1.00	1.60	0.0394	0.0630
D	1.03	1.07	0.0406	0.0421
E	2.54 typ.		0.1 typ.	
F	0.65	0.85	0.0256	0.0335
G	5.08 typ.		0.2 typ.	
H	4.30	4.50	0.1693	0.1772
K	1.17	1.37	0.0461	0.0539
L	9.05	9.45	0.3563	0.3720
M	2.30	2.50	0.0906	0.0984
N	15 typ.		0.5906 typ.	
P	0.00	0.20	0.0000	0.0079
Q	4.20	5.20	0.1654	0.2047
R	8° max		8° max	
S	2.40	3.00	0.0945	0.1181
T	0.40	0.60	0.0157	0.0236
U	10.80		0.4252	
V	1.15		0.0453	
W	6.23		0.2453	
X	4.60		0.1811	
Y	9.40		0.3701	
Z	16.15		0.6358	

TO-252AA (DPak)



symbol	dimensions			
	[mm]		symbol	
	min		min	
A	6.40	A	6.40	A
B	5.25	B	5.25	B
C	(0.65)	C	(0.65)	C
D	0.63	D	0.63	D
E	2.28		E	
F	2.19	F	2.19	F
G	0.76	G	0.76	G
H	0.90	H	0.90	H
K	5.97	K	5.97	K
L	9.40	L	9.40	L
M	0.46	M	0.46	M
N	0.87	N	0.87	N
P	0.51	P	0.51	P
R	5.00	R	5.00	R
S	4.17	S	4.17	S
T	0.26	T	0.26	T
U	-	U	-	U

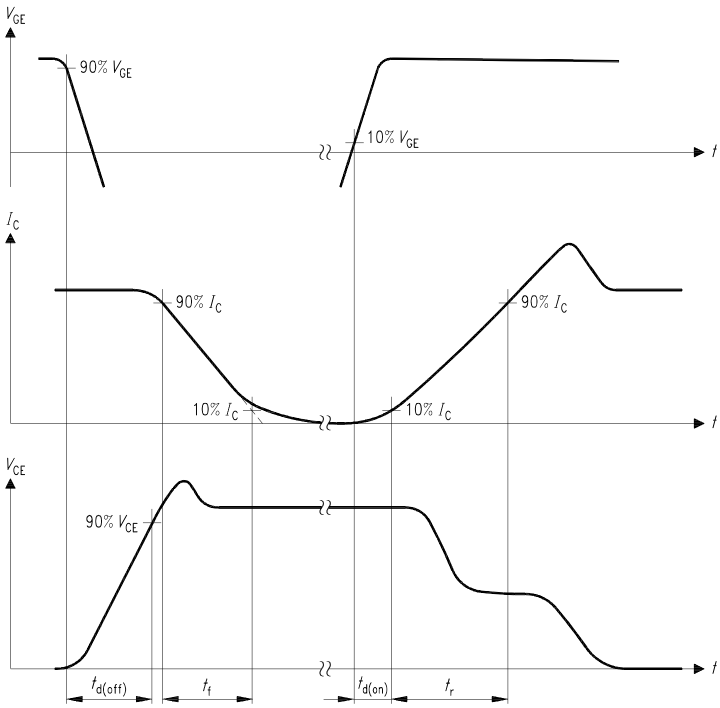


Figure A. Definition of switching times

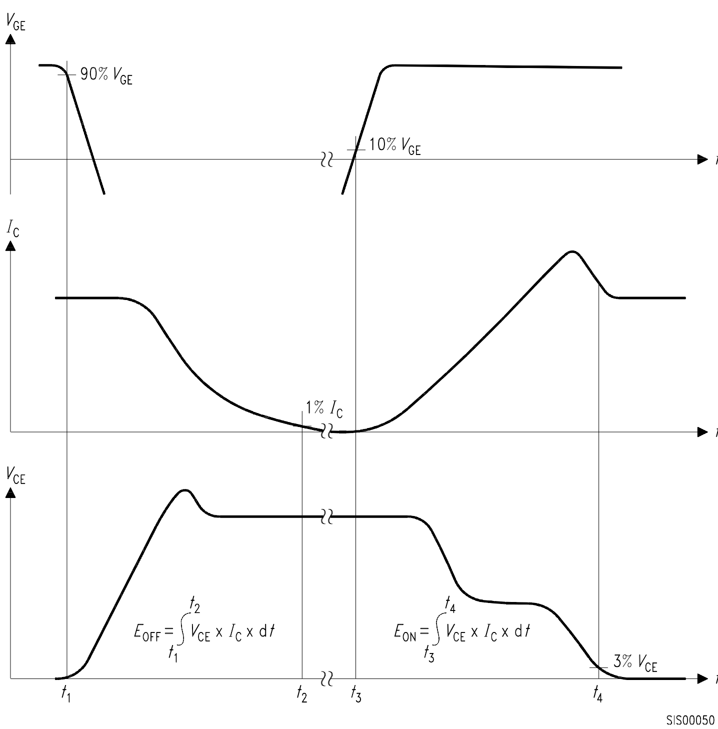


Figure B. Definition of switching losses

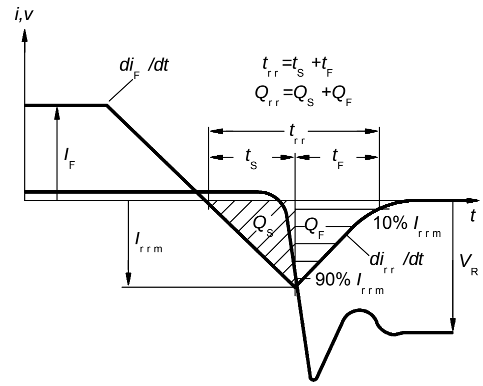


Figure C. Definition of diodes switching characteristics

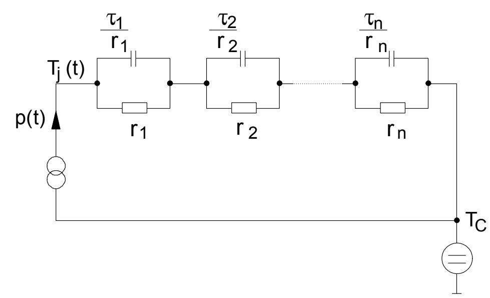


Figure D. Thermal equivalent circuit

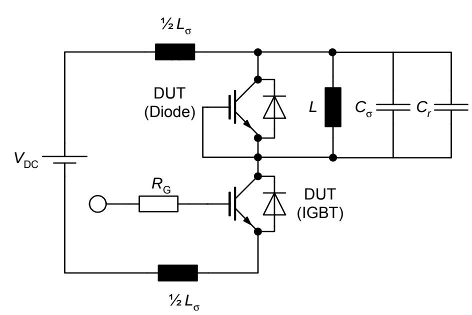


Figure E. Dynamic test circuit
Leakage inductance L_σ = 180nH,
Stray capacitor C_σ = 40pF,
Relief capacitor C_r = 1nF (only for ZVT switching)

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