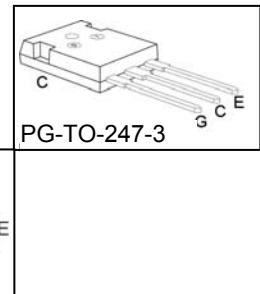
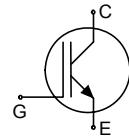


HighSpeed 2-Technology

- 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 $I_C = 3\text{A}$
- Qualified according to JEDEC² for target applications
- Pb-free lead plating; RoHS compliant
- Complete product spectrum and PSpice Models : <http://www.infineon.com/igbt/>



Type	V_{CE}	I_C	E_{off}	T_j	Marking	Package
IGW03N120H2	1200V	3A	0.15mJ	150°C	G03H1202	PG-T0-247-3
IGP03N120H2	1200V	3A	0.15mJ	150°C	G03H1202	PG-T0-220-3-1

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CE}	1200	V
Triangular collector current $T_C = 25^\circ\text{C}, f = 140\text{kHz}$	I_C	9.6	A
$T_C = 100^\circ\text{C}, f = 140\text{kHz}$		3.9	
Pulsed collector current, t_p limited by $T_{j\max}$	$I_{C\text{puls}}$	9.9	
Turn off safe operating area	-	9.9	
$V_{CE} \leq 1200\text{V}, T_j \leq 150^\circ\text{C}$			
Gate-emitter voltage	V_{GE}	± 20	V
Power dissipation $T_C = 25^\circ\text{C}$	P_{tot}	62.5	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	

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	R_{thJA}	PG-TO-220-3-1 PG-TO-247-3	62 40	

Electrical Characteristic, at $T_j = 25^\circ\text{C}$, unless otherwise specified

Parameter	Symbol	Conditions	Value			Unit
			min.	Typ.	max.	

Static Characteristic

Collector-emitter breakdown voltage	$V_{(BR)CES}$	$V_{GE}=0\text{V}, I_C=300\mu\text{A}$	1200	-	-	V
Collector-emitter saturation voltage	$V_{CE(\text{sat})}$	$V_{GE} = 15\text{V}, I_C=3\text{A}$ $T_j=25^\circ\text{C}$ $T_j=150^\circ\text{C}$ $V_{GE} = 10\text{V}, I_C=3\text{A},$ $T_j=25^\circ\text{C}$	-	2.2	2.8	
Gate-emitter threshold voltage	$V_{GE(\text{th})}$	$I_C=90\mu\text{A}, V_{CE}=V_{GE}$	2.1	3	3.9	
Zero gate voltage collector current	I_{CES}	$V_{CE}=1200\text{V}, V_{GE}=0\text{V}$ $T_j=25^\circ\text{C}$ $T_j=150^\circ\text{C}$	-	-	20	μA
Gate-emitter leakage current	I_{GES}	$V_{CE}=0\text{V}, V_{GE}=20\text{V}$	-	-	100	nA
Transconductance	g_{fs}	$V_{CE}=20\text{V}, I_C=3\text{A}$	-	2	-	S

Dynamic Characteristic

Input capacitance	C_{iss}	$V_{CE}=25\text{V},$ $V_{GE}=0\text{V},$ $f=1\text{MHz}$	-	205	-	pF
Output capacitance	C_{oss}		-	24	-	
Reverse transfer capacitance	C_{rss}		-	7	-	
Gate charge	Q_{Gate}	$V_{CC}=960\text{V}, I_C=3\text{A}$ $V_{GE}=15\text{V}$	-	22	-	nC
Internal emitter inductance measured 5mm (0.197 in.) from case	L_E	PG-TO-220-3-1 PG-TO-247-3	-	7	-	nH
			-	13	-	

Switching Characteristic, Inductive Load, at $T_j=25\text{ }^\circ\text{C}$

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
IGBT Characteristic						
Turn-on delay time	$t_{d(on)}$	$T_j=25\text{ }^\circ\text{C}$, $V_{CC}=800\text{V}$, $I_C=3\text{A}$, $V_{GE}=15\text{V}/0\text{V}$, $R_G=82\Omega$, $L_\sigma^{(2)}=180\text{nH}$, $C_\sigma^{(2)}=40\text{pF}$ Energy losses include "tail" and diode ³⁾ 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 $T_j=150\text{ }^\circ\text{C}$

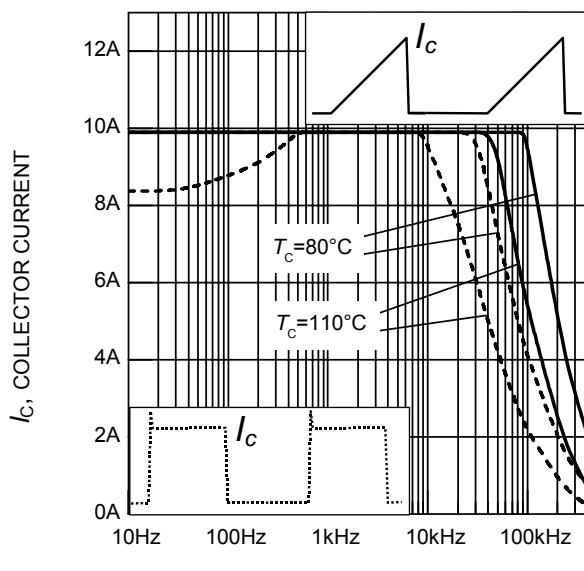
Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
IGBT Characteristic						
Turn-on delay time	$t_{d(on)}$	$T_j=150\text{ }^\circ\text{C}$, $V_{CC}=800\text{V}$, $I_C=3\text{A}$, $V_{GE}=15\text{V}/0\text{V}$, $R_G=82\Omega$, $L_\sigma^{(2)}=180\text{nH}$, $C_\sigma^{(2)}=40\text{pF}$ Energy 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}	$V_{CC}=800\text{V}$, $I_C=3\text{A}$, $V_{GE}=15\text{V}/0\text{V}$, $R_G=82\Omega$, $C_r^{(2)}=4\text{nF}$ $T_j=25\text{ }^\circ\text{C}$ $T_j=150\text{ }^\circ\text{C}$	-	0.05	-	mJ

²⁾ Leakage inductance L_σ and stray capacity C_σ due to dynamic test circuit in figure E

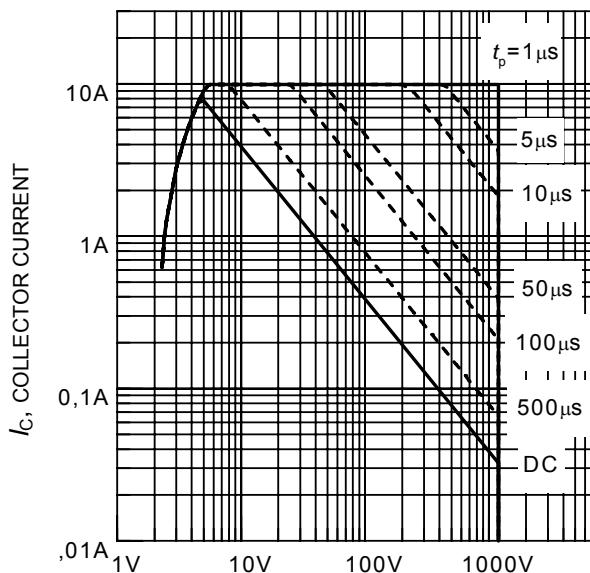
³⁾ Commutation diode from device IKP03N120H2



f , SWITCHING FREQUENCY

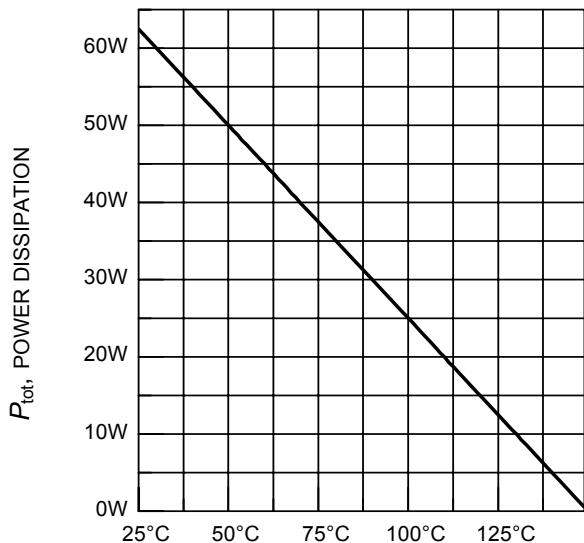
Figure 1. Collector current as a function of switching frequency

($T_j \leq 150^\circ\text{C}$, $D = 0.5$, $V_{\text{CE}} = 800\text{V}$,
 $V_{\text{GE}} = +15\text{V}/0\text{V}$, $R_G = 82\Omega$)



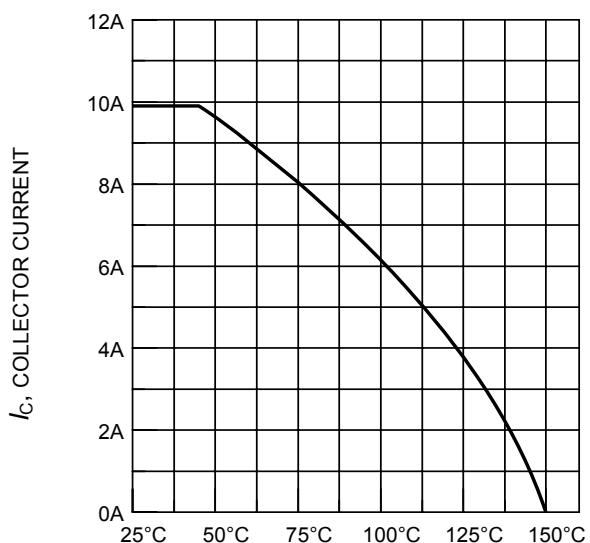
V_{CE} , COLLECTOR-EMITTER VOLTAGE

Figure 2. Safe operating area
 $(D = 0, T_C = 25^\circ\text{C}, T_j \leq 150^\circ\text{C})$



T_C , CASE TEMPERATURE

Figure 3. Power dissipation as a function of case temperature
 $(T_j \leq 150^\circ\text{C})$



T_C , CASE TEMPERATURE

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

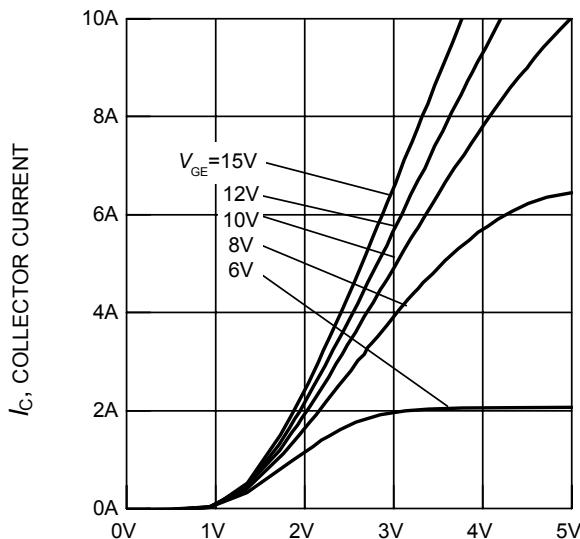

 V_{CE} , COLLECTOR-EMITTER VOLTAGE

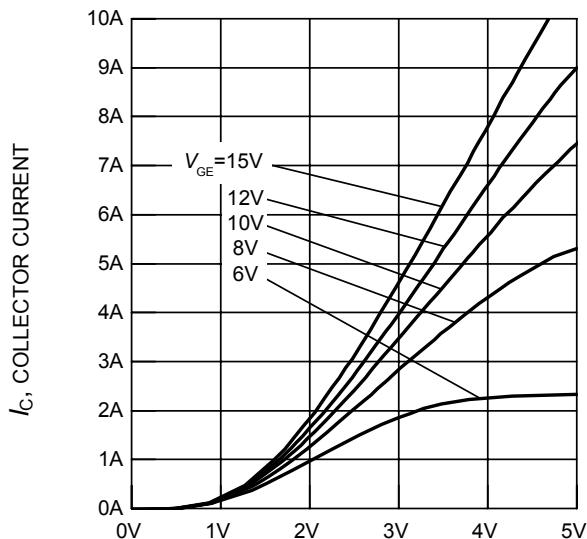
Figure 5. Typical output characteristics
 $(T_j = 25^\circ\text{C})$

 V_{CE} , COLLECTOR-EMITTER VOLTAGE

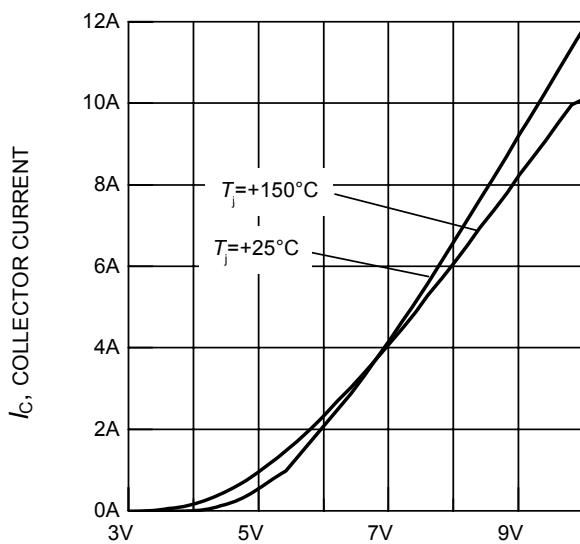
Figure 6. Typical output characteristics
 $(T_j = 150^\circ\text{C})$

 V_{GE} , GATE-EMITTER VOLTAGE

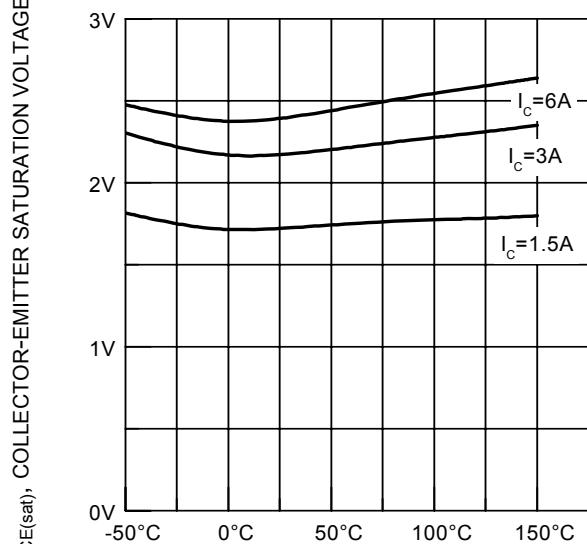
Figure 7. Typical transfer characteristics
 $(V_{CE} = 20\text{V})$

 T_j , JUNCTION TEMPERATURE

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

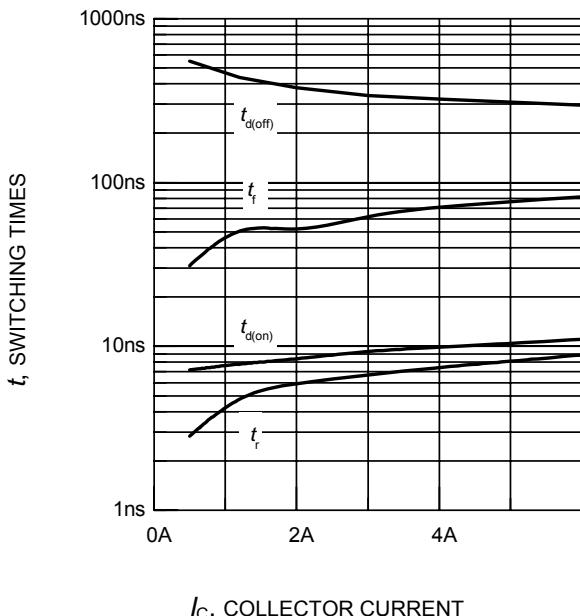

 I_C , COLLECTOR CURRENT

Figure 9. Typical switching times as a function of collector current

(inductive load, $T_j = 150^\circ\text{C}$,
 $V_{CE} = 800\text{V}$, $V_{GE} = +15\text{V}/0\text{V}$, $R_G = 82\Omega$,
dynamic test circuit in Fig.E)

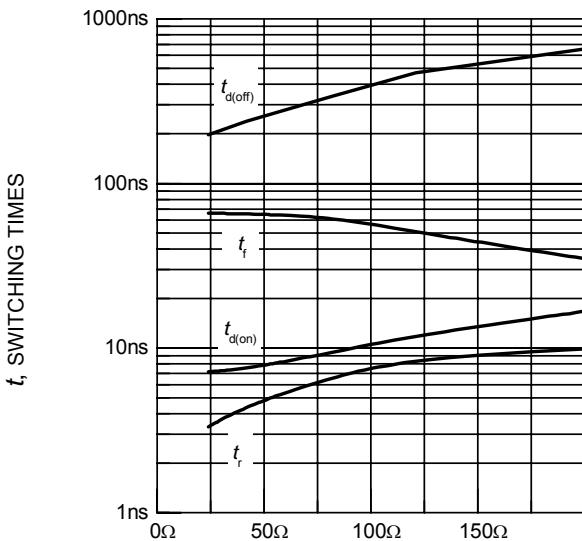

 R_G , GATE RESISTOR

Figure 10. Typical switching times as a function of gate resistor

(inductive load, $T_j = 150^\circ\text{C}$,
 $V_{CE} = 800\text{V}$, $V_{GE} = +15\text{V}/0\text{V}$, $I_C = 3\text{A}$,
dynamic test circuit in Fig.E)

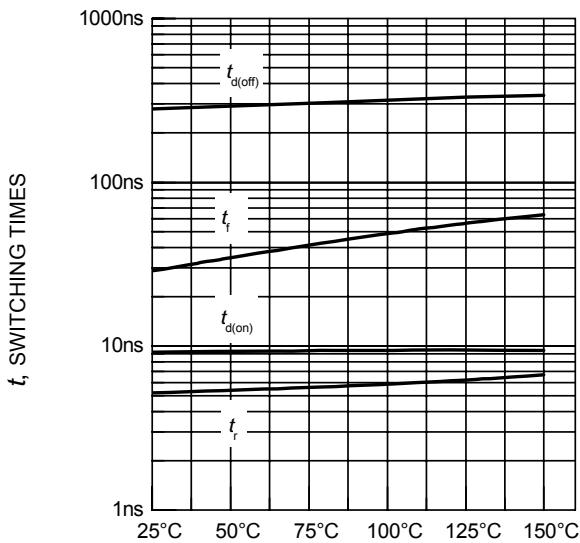

 T_j , JUNCTION TEMPERATURE

Figure 11. Typical switching times as a function of junction temperature

(inductive load, $V_{CE} = 800\text{V}$,
 $V_{GE} = +15\text{V}/0\text{V}$, $I_C = 3\text{A}$, $R_G = 82\Omega$,
dynamic test circuit in Fig.E)

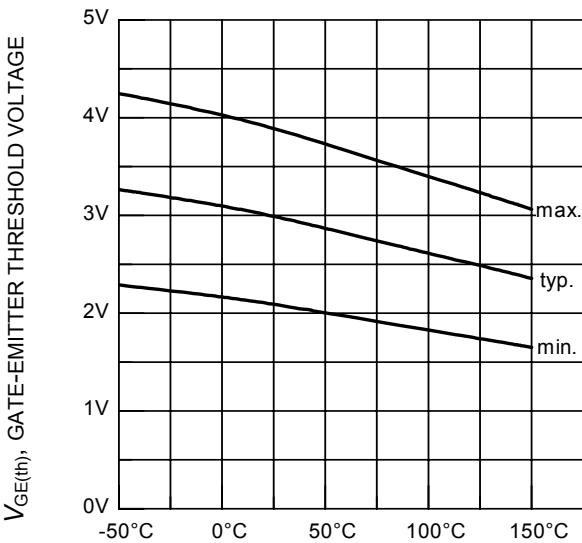

 T_j , JUNCTION TEMPERATURE

Figure 12. Gate-emitter threshold voltage as a function of junction temperature

($I_C = 0.09\text{mA}$)

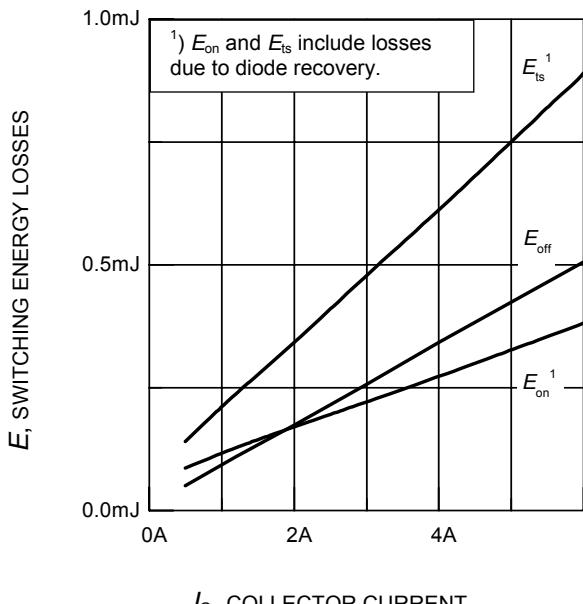

 I_C , COLLECTOR CURRENT

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

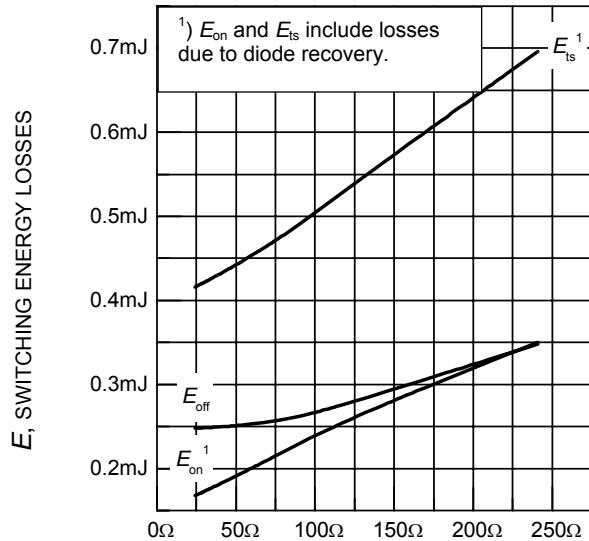

 R_G , GATE RESISTOR

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

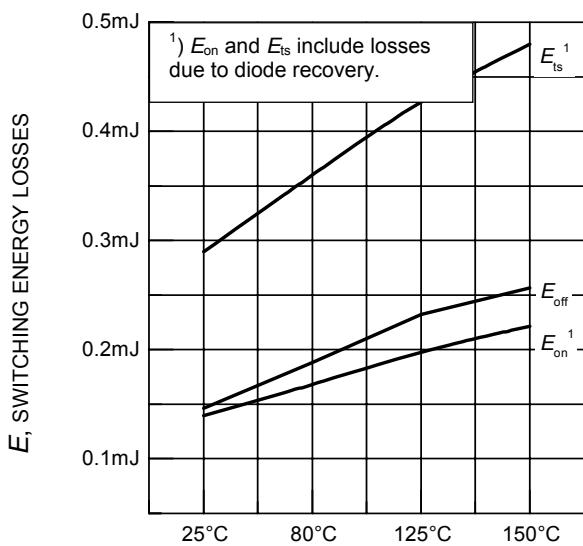

 T_j , JUNCTION TEMPERATURE

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

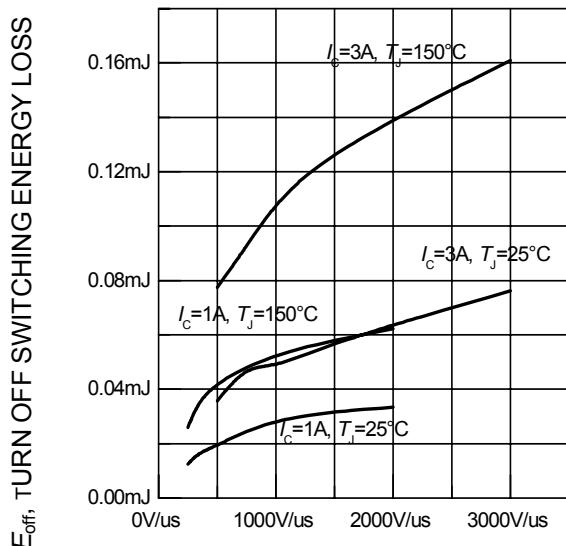
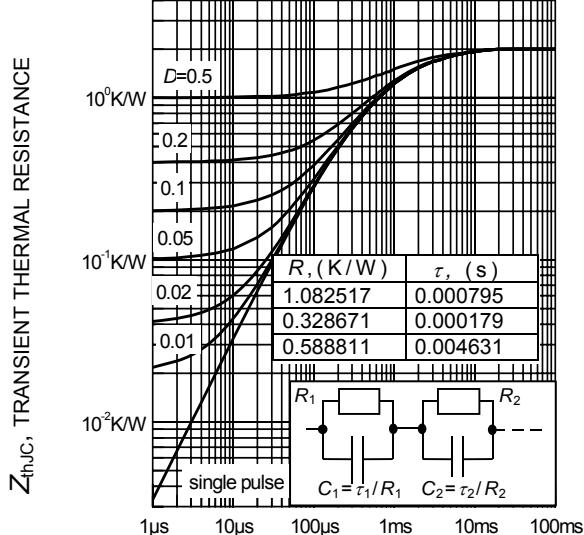
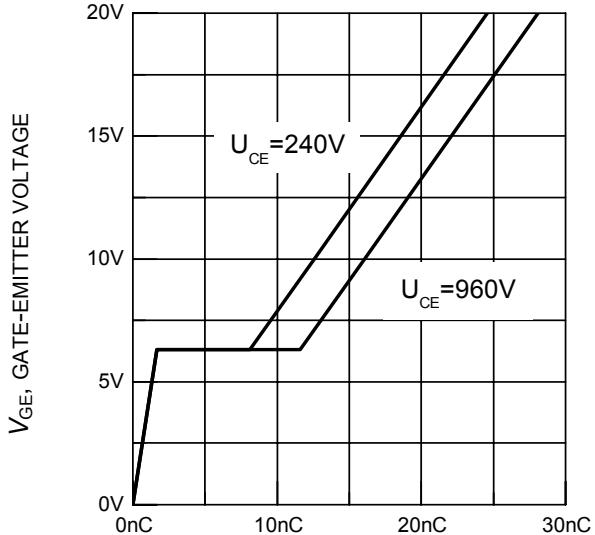

 dV/dt , VOLTAGE SLOPE

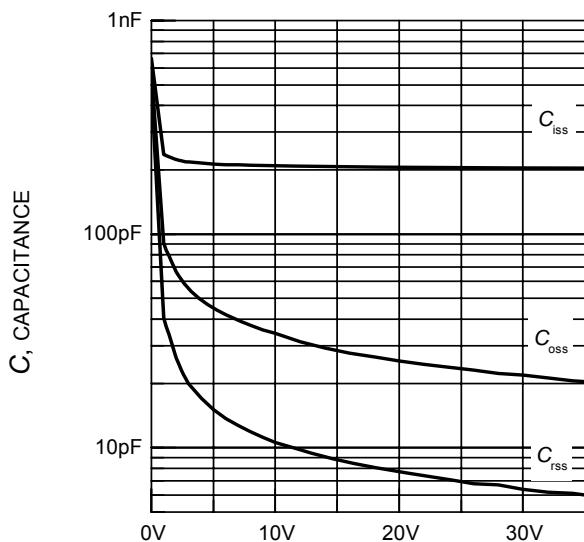
Figure 16. Typical turn off switching energy loss for soft switching
(dynamic test circuit in Fig. E)



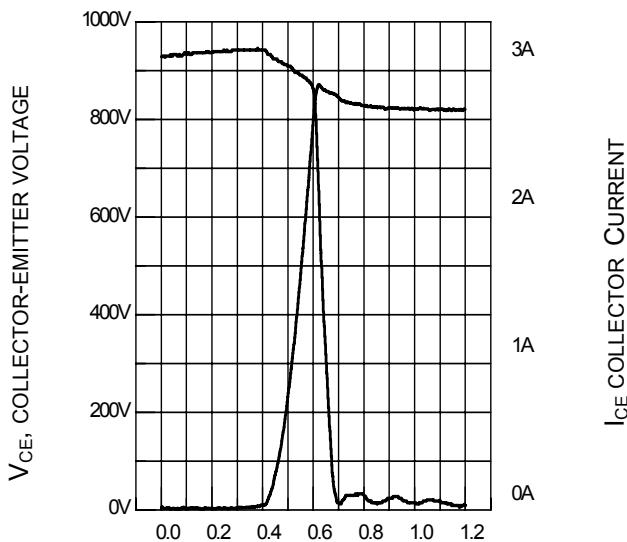
Q_{GE} , GATE CHARGE
Figure 16. IGBT transient thermal resistance
 $(D = t_p / T)$



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
 $(V_{GE}=15/0V, R_G=82\Omega, T_j = 150^\circ C,$
Dynamic test circuit in Figure E)

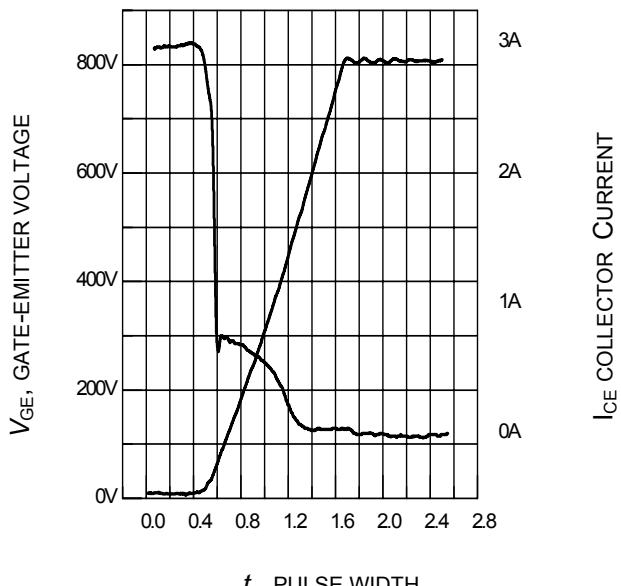
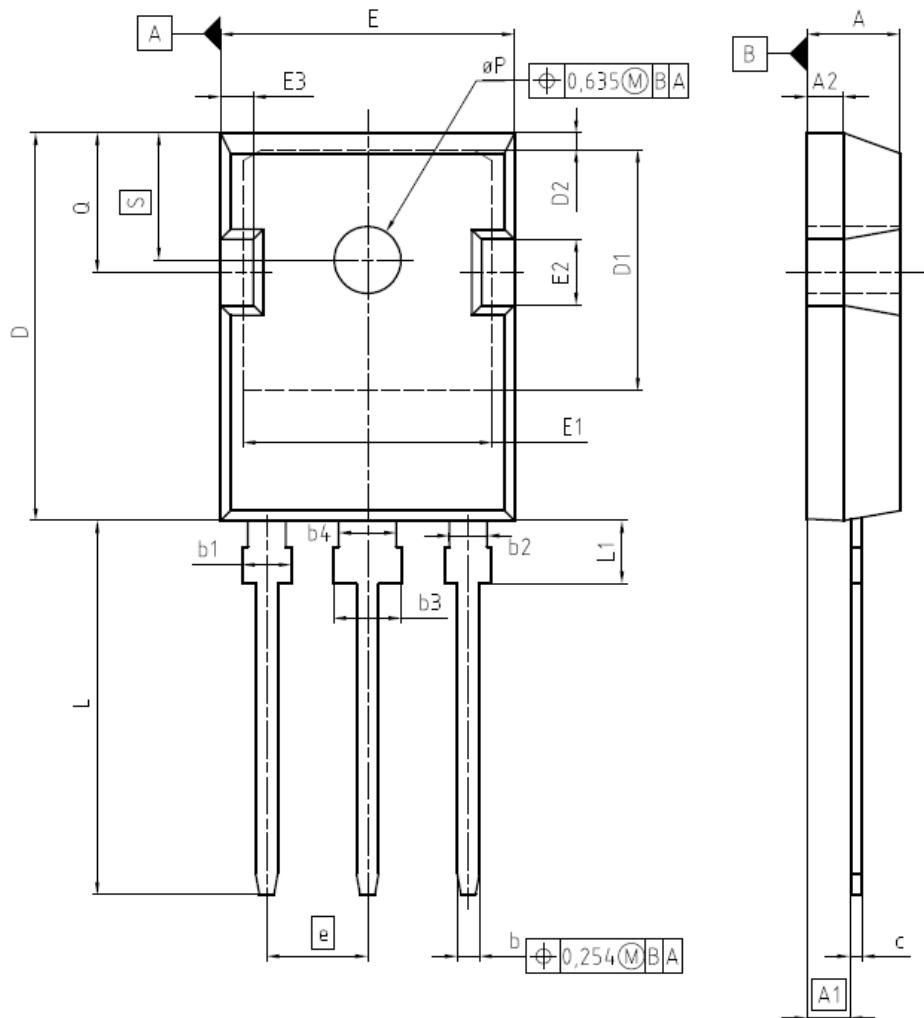

 t_p , PULSE WIDTH

Figure 21. Typical turn off behavior, soft switching

($V_{GE}=15.0\text{V}$, $R_G=82\Omega$, $T_j = 150^\circ\text{C}$,
Dynamic test circuit in Figure E)

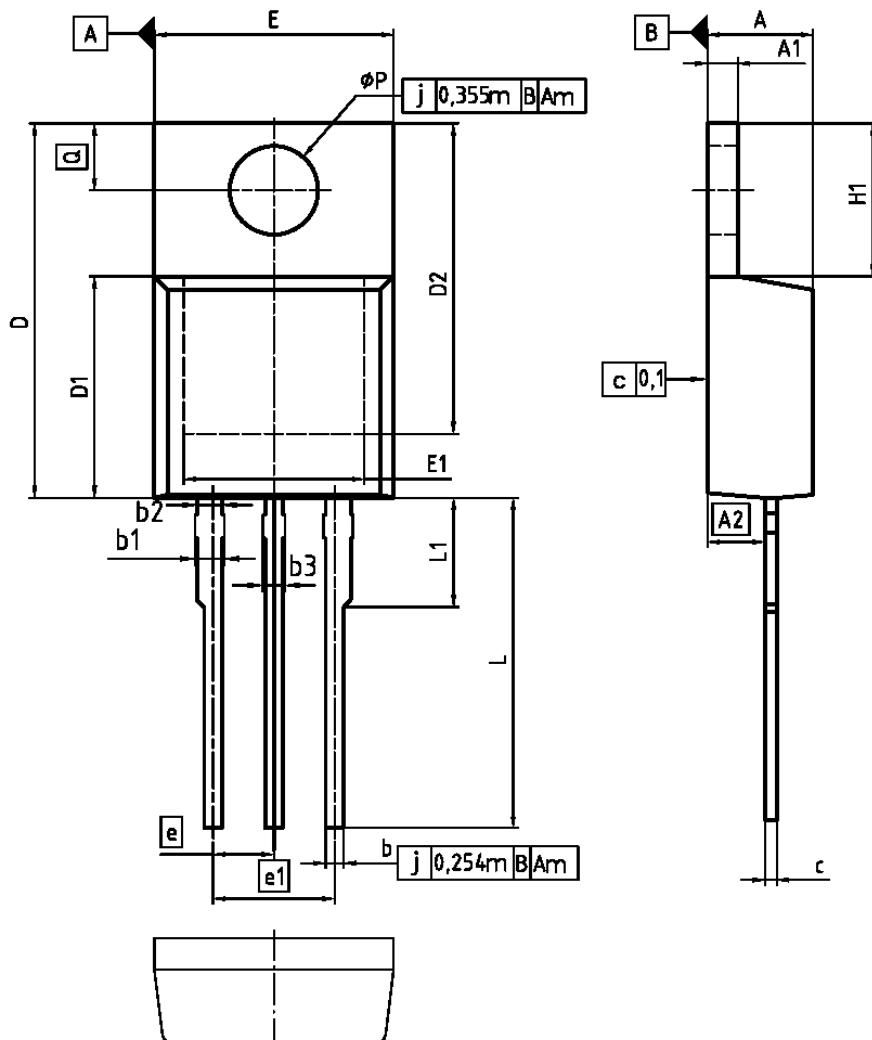
PG-T0247-3



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.90	5.16	0.193	0.203
A1	2.27	2.53	0.089	0.099
A2	1.85	2.11	0.073	0.083
b	1.07	1.33	0.042	0.052
b1	1.90	2.41	0.075	0.095
b2	1.90	2.16	0.075	0.085
b3	2.87	3.38	0.113	0.133
b4	2.87	3.13	0.113	0.123
c	0.55	0.68	0.022	0.027
D	20.82	21.10	0.820	0.831
D1	16.25	17.65	0.640	0.695
D2	1.05	1.35	0.041	0.053
E	15.70	16.03	0.618	0.631
E1	13.10	14.15	0.516	0.557
E2	3.68	5.10	0.145	0.201
E3	1.68	2.60	0.066	0.102
e	5.44		0.214	
N	3		3	
L	19.80	20.31	0.780	0.799
L1	4.17	4.47	0.164	0.176
ØP	3.50	3.70	0.138	0.146
Q	5.49	6.00	0.216	0.236
S	6.04	6.30	0.238	0.248

DOCUMENT NO.	
Z8B00003327	
SCALE	0
0	5
5	7.5mm
EUROPEAN PROJECTION	
ISSUE DATE	
17-12-2007	
REVISION	
03	

PG-T0220-3-1



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.30	4.57	0.169	0.180
A1	1.17	1.40	0.046	0.055
A2	2.15	2.72	0.085	0.107
b	0.65	0.86	0.026	0.034
b1	0.95	1.40	0.037	0.055
b2	0.95	1.15	0.037	0.045
b3	0.85	1.15	0.026	0.045
c	0.33	0.80	0.013	0.024
D	14.81	15.95	0.583	0.628
D1	8.51	9.45	0.335	0.372
D2	12.19	13.10	0.480	0.518
E	9.70	10.36	0.382	0.408
E1	6.50	8.60	0.256	0.339
e	2.54		0.100	
e1	5.08		0.200	
N	3		3	
H1	5.90	6.90	0.232	0.272
L	13.00	14.00	0.512	0.551
L1	-	4.80	-	0.189
φP	3.80	3.89	0.142	0.153
Q	2.60	3.00	0.102	0.118

DOCUMENT NO.
ZBB00003318
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0 2.5
5mm
EUROPEAN PROJECTION
ISSUE DATE
23-08-2007
REVISION
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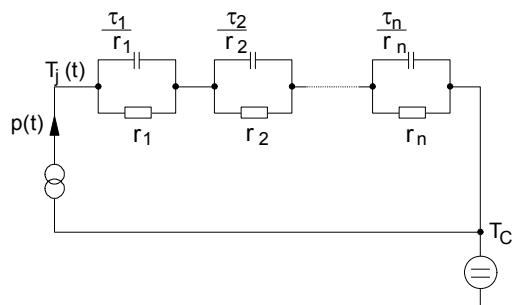
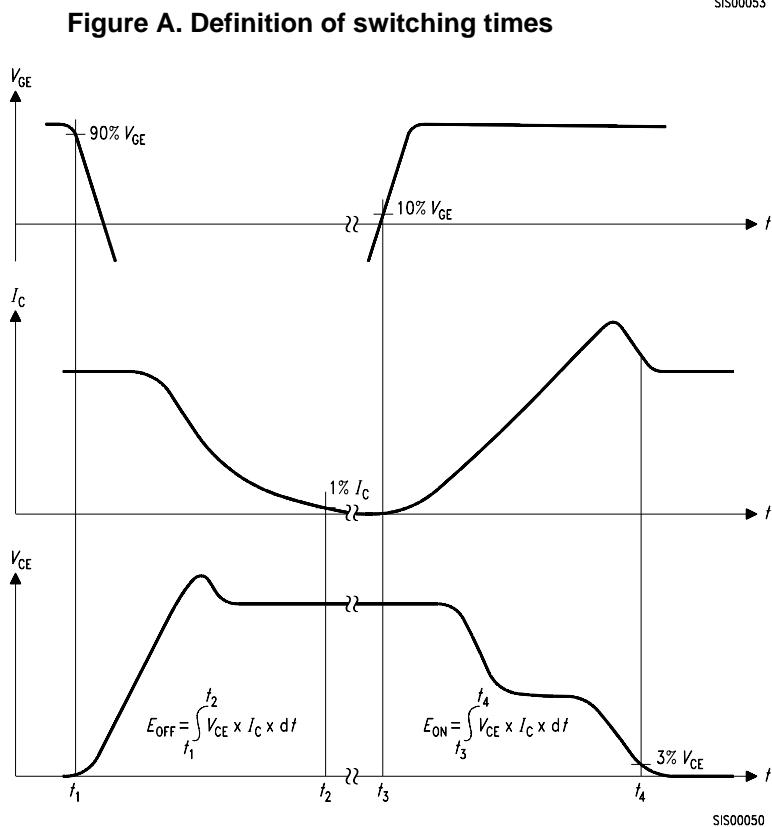
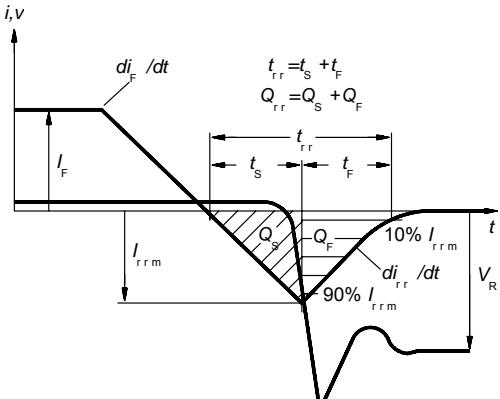
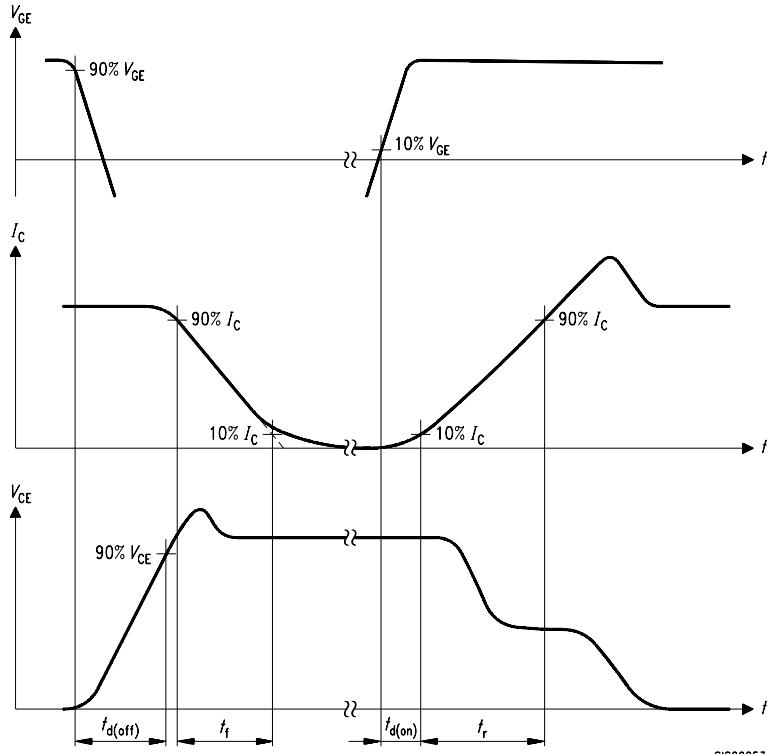


Figure D. Thermal equivalent circuit

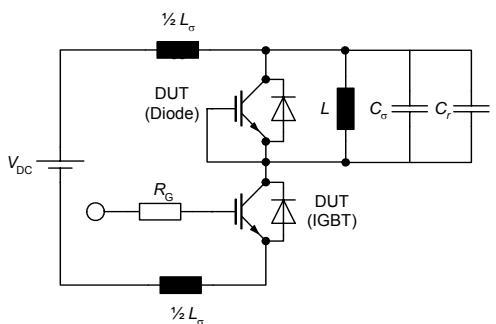


Figure E. Dynamic test circuit
 Leakage inductance $L_\sigma = 180\text{nH}$,
 Stray capacitor $C_\sigma = 40\text{pF}$,
 Relief capacitor $C_r = 4\text{nF}$ (only for ZVT switching)

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Электрон
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Промышленная ул, дом № 19, литер Н,
помещение 100-Н Офис 331