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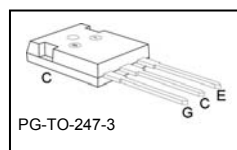
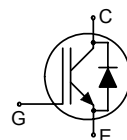
Soft Switching Series

IHW30N90R

Reverse Conducting IGBT with monolithic body diode

Features:

- 1.5V typical saturation voltage of IGBT
- Trench and Fieldstop technology for 900 V applications offers :
 - very tight parameter distribution
 - high ruggedness, temperature stable behavior
 - easy parallel switching capability due to positive temperature coefficient in $V_{CE(sat)}$
- Low EMI
- Qualified according to JEDEC¹ for target applications
- Application specific optimisation of inverse diode
- Pb-free lead plating; RoHS compliant



Applications:

- Microwave Oven
- Soft Switching Applications for ZCS

Type	V_{CE}	I_C	$V_{CE(sat)}, T_j=25^\circ\text{C}$	$T_{j,max}$	Marking	Package
IHW30N90R	900V	30A	1.5V	175°C	H30R90	PG-TO-247-3

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CE}	900	V
DC collector current	I_C	60 30	A
$T_C = 25^\circ\text{C}$			
$T_C = 100^\circ\text{C}$			
Pulsed collector current, t_p limited by $T_{j,max}$	$I_{C,puls}$	90	
Turn off safe operating area $V_{CE} \leq 900\text{V}$, $T_j \leq 175^\circ\text{C}$	-	90	
Diode forward current	I_F	60 30	
$T_C = 25^\circ\text{C}$			
$T_C = 100^\circ\text{C}$			
Diode pulsed current, t_p limited by $T_{j,max}$	$I_{F,puls}$	90	
Gate-emitter voltage	V_{GE}	± 20	V
Transient Gate-emitter voltage ($t_p < 5\text{ ms}$)		± 25	
Power dissipation, $T_C = 25^\circ\text{C}$	P_{tot}	454	W
Operating junction temperature	T_j	-40...+175	°C
Storage temperature	T_{stg}	-55...+175	°C
Soldering temperature, 1.6mm (0.063 in.) from case for 10s	-	260	

¹ J-STD-020 and JESD-022



IHW30N90R

Soft Switching Series

Thermal Resistance

Parameter	Symbol	Conditions	Max. Value	Unit
Characteristic				
IGBT thermal resistance, junction – case	R_{thJC}		0.33	K/W
Diode thermal resistance, junction – case	R_{thJCD}		0.33	
Thermal resistance, junction – ambient	R_{thJA}		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	$V_{(BR)CES}$	$V_{GE}=0V, I_C=0.5mA$	900	-	-	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	$V_{GE} = 15V, I_C=30A$ $T_j=25^{\circ}C$ $T_j=150^{\circ}C$ $T_j=175^{\circ}C$	 - - -	 1.5 1.6 1.7	 1.7 - -	
Diode forward voltage	V_F	$V_{GE}=0V, I_F=30A$ $T_j=25^{\circ}C$ $T_j=150^{\circ}C$ $T_j=175^{\circ}C$	 - - -	 1.4 1.4 1.45	 1.6 - -	
Gate-emitter threshold voltage	$V_{GE(th)}$	$I_C=700\mu A, V_{CE}=V_{GE}$	5.1	5.8	6.4	
Zero gate voltage collector current	I_{CES}	$V_{CE}=900V, V_{GE}=0V$ $T_j=25^{\circ}C$ $T_j=150^{\circ}C$	 - -	 - -	 5 2500	
Gate-emitter leakage current	I_{GES}	$V_{CE}=0V, V_{GE}=20V$	-	-	600	nA



IHW30N90R

Soft Switching Series

Dynamic Characteristic

Input capacitance	C_{iss}	$V_{CE}=25V,$ $V_{GE}=0V,$ $f=1MHz$	-	2889	-	pF
Output capacitance	C_{oss}		-	83	-	
Reverse transfer capacitance	C_{rss}		-	79	-	
Gate charge	Q_{Gate}	$V_{CC}=720V, I_C=30A$ $V_{GE}=15V$	-	200	-	nC
Internal emitter inductance measured 5mm (0.197 in.) from case	L_E		-	13	-	nH

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

Parameter	Symbol	Conditions	Value			Unit
			min.	Typ.	Max.	
IGBT Characteristic						
Turn-off delay time	$t_{d(off)}$	$T_J=25^{\circ}C$ $V_{CC}=600V,$ $I_C=30A,$ $V_{GE}=0/15V,$ $R_G=15\Omega$	-	511	-	mJ
Fall time	t_f		-	24	-	
Turn-on energy	E_{on}		-	-	-	
Turn-off energy	E_{off}		-	1.46	-	
Total switching energy	E_{ts}		-	1.46	-	

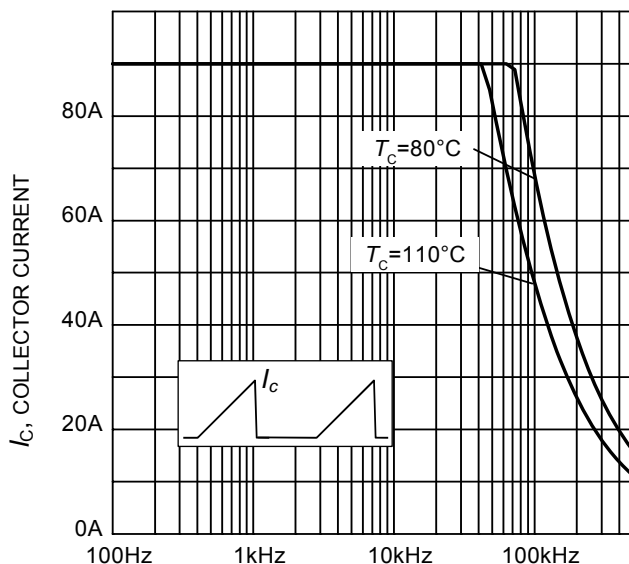
Switching Characteristic, Inductive Load, at $T_j=175^\circ C$

Parameter	Symbol	Conditions	Value			Unit
			min.	Typ.	max.	
IGBT Characteristic						
Turn-off delay time	$t_{d(off)}$	$T_J=175^{\circ}C$ $V_{CC}=600V,$ $I_C=30A,$ $V_{GE}=0/15V,$ $R_G=15\Omega$	-	594	-	mJ
Fall time	t_f		-	46	-	
Turn-on energy	E_{on}		-	-	-	
Turn-off energy	E_{off}		-	2.1	-	
Total switching energy	E_{ts}		-	2.1	-	



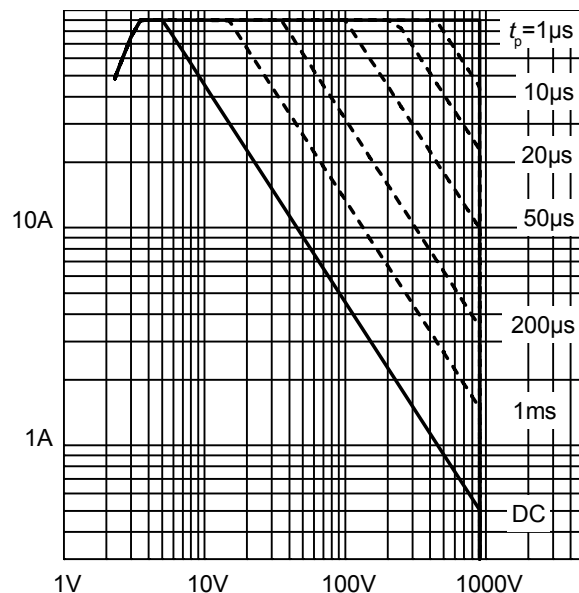
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IHW30N90R



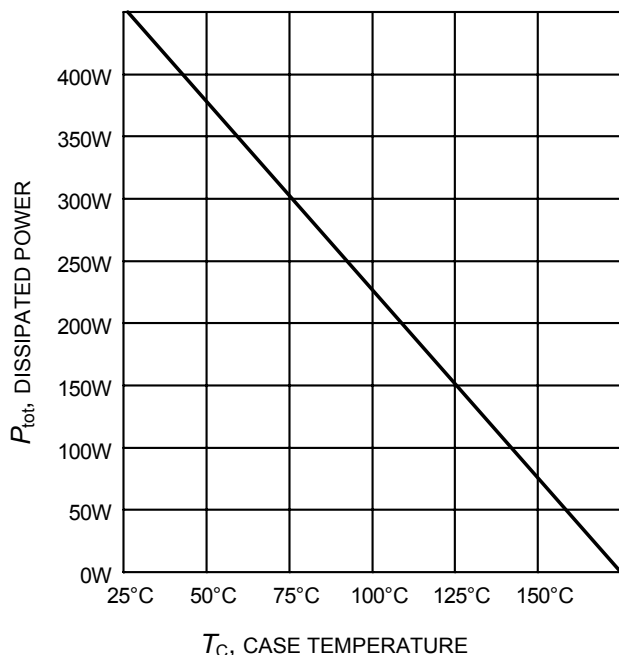
f_i , SWITCHING FREQUENCY

Figure 1. Collector current as a function of switching frequency for triangular current ($E_{on} = 0$, hard turn-off)
($T_j \leq 175^\circ\text{C}$, $D = 0.5$, $V_{CE} = 600\text{V}$, $V_{GE} = 0/+15\text{V}$, $R_G = 15\Omega$)



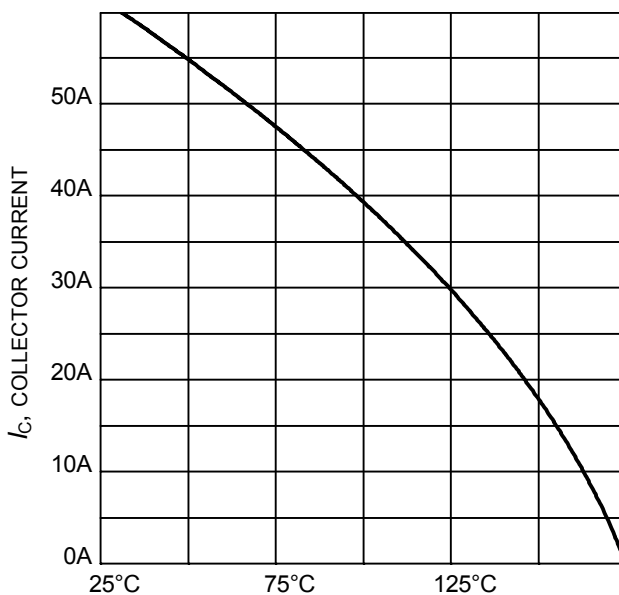
V_{CE} , COLLECTOR-EMITTER VOLTAGE

Figure 2. IGBT Safe operating area
($D = 0$, $T_C = 25^\circ\text{C}$, $T_j \leq 175^\circ\text{C}$; $V_{GE} = 15\text{V}$)



T_C , CASE TEMPERATURE

Figure 3. Power dissipation as a function of case temperature
($T_j \leq 175^\circ\text{C}$)



T_C , CASE TEMPERATURE

Figure 4. Collector current as a function of case temperature
($V_{GE} \geq 15\text{V}$, $T_j \leq 175^\circ\text{C}$)



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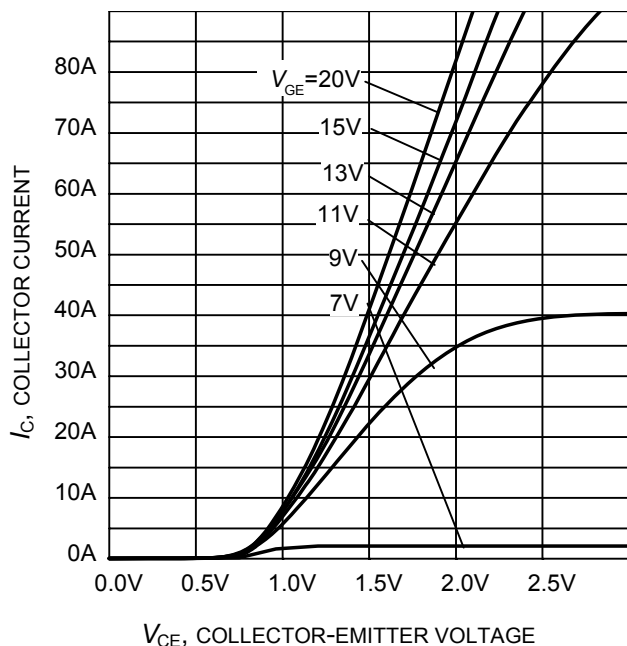


Figure 5. Typical output characteristic
($T_J = 25^\circ\text{C}$)

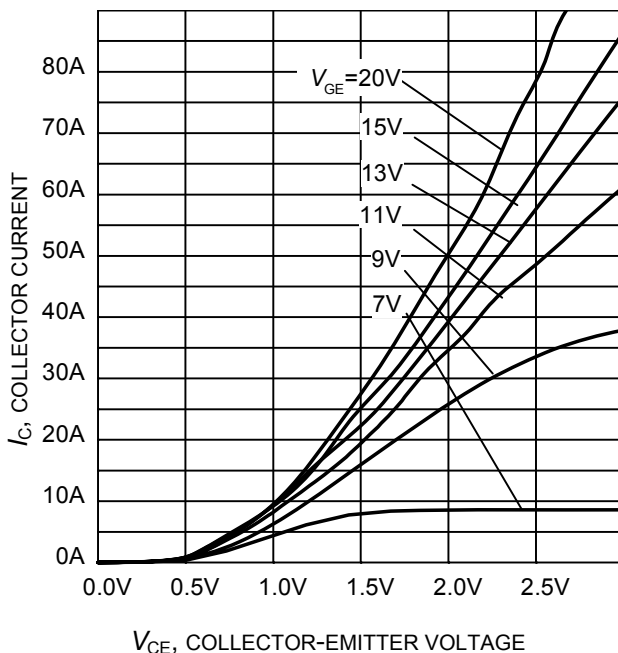


Figure 6. Typical output characteristic
($T_J = 175^\circ\text{C}$)

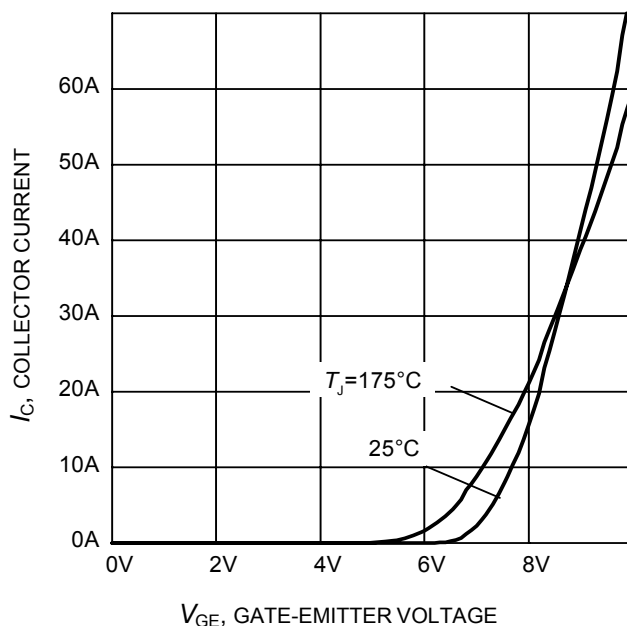


Figure 7. Typical transfer characteristic
($V_{CE} = 20\text{V}$)

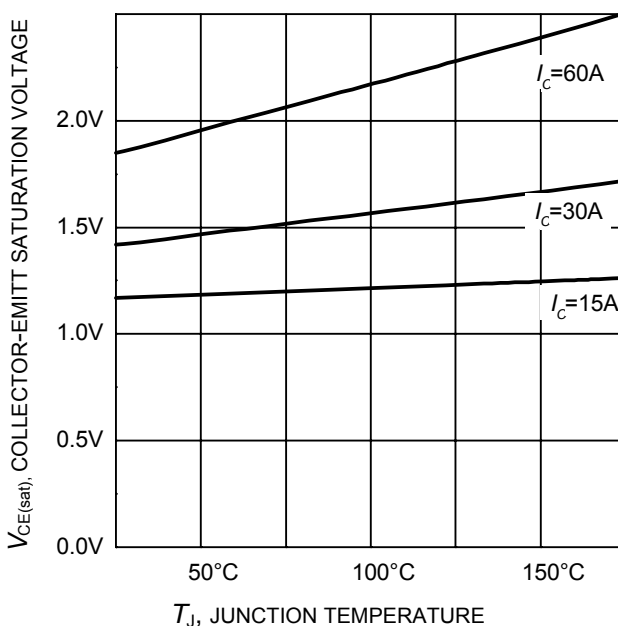


Figure 8. Typical collector-emitter saturation voltage as a function of junction temperature
($V_{GE} = 15\text{V}$)



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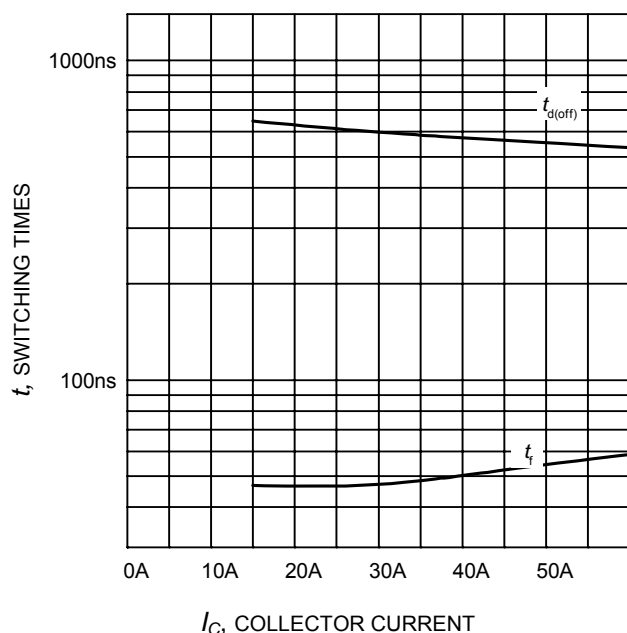


Figure 9. Typical switching times as a function of collector current
(inductive load, $T_J=175^\circ\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $R_G=15\Omega$, Dynamic test circuit in Figure E)

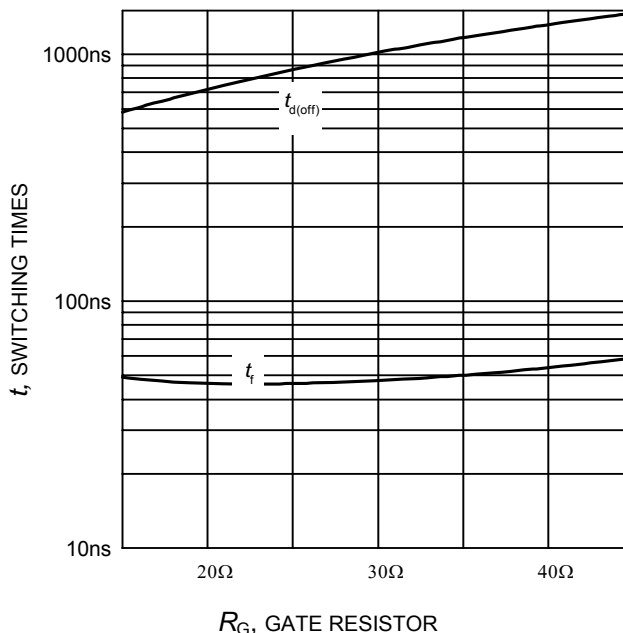


Figure 10. Typical switching times as a function of gate resistor
(inductive load, $T_J=175^\circ\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=30\text{A}$, Dynamic test circuit in Figure E)

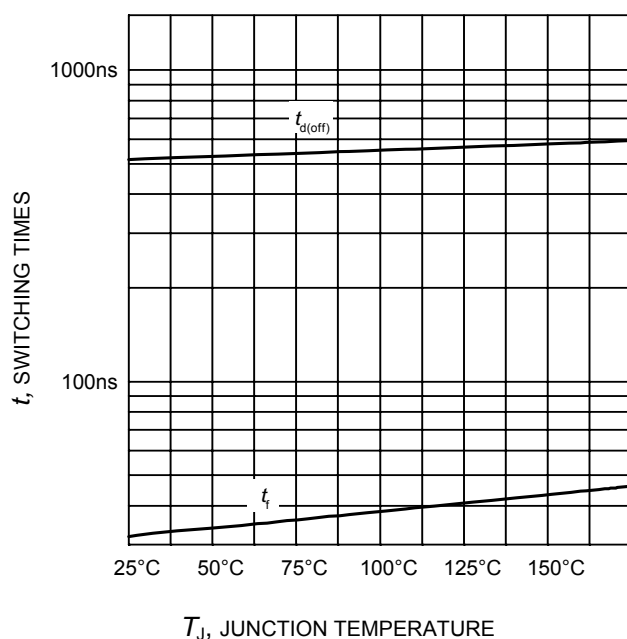


Figure 11. Typical switching times as a function of junction temperature
(inductive load, $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=30\text{A}$, $R_G=15\Omega$, Dynamic test circuit in Figure E)

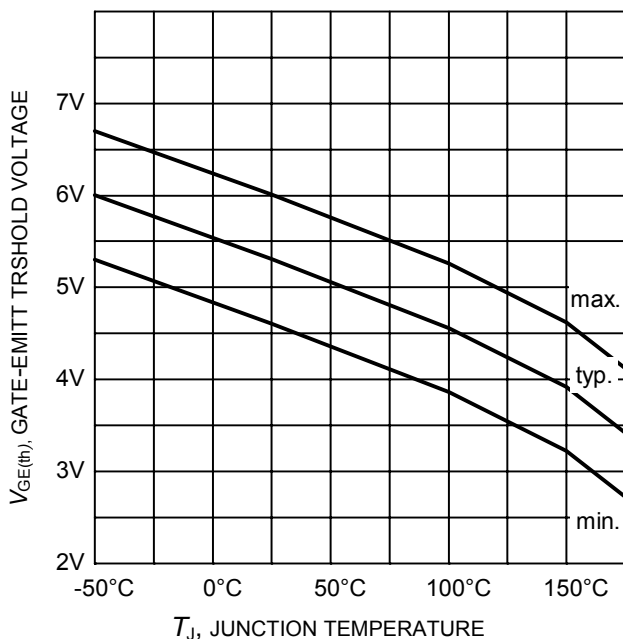


Figure 12. Gate-emitter threshold voltage as a function of junction temperature
($I_C = 0.7\text{mA}$)



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Soft Switching Series

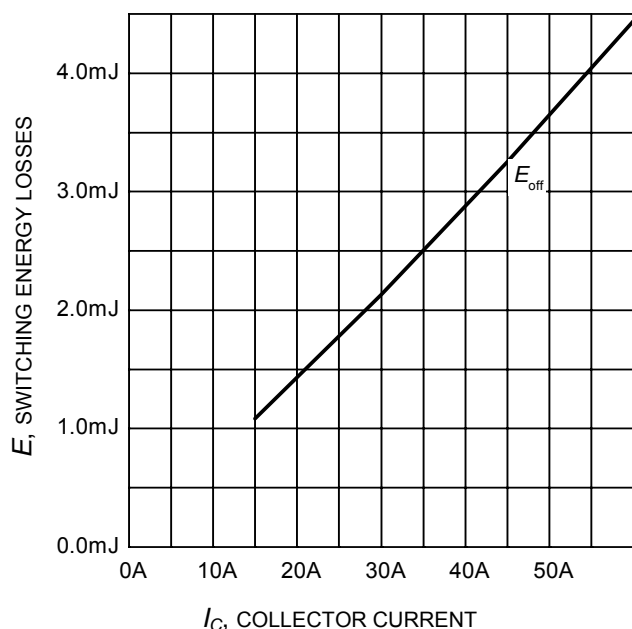


Figure 13. Typical switching energy losses as a function of collector current
(inductive load, $T_J=175^\circ\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $R_G=15\Omega$, Dynamic test circuit in Figure E)

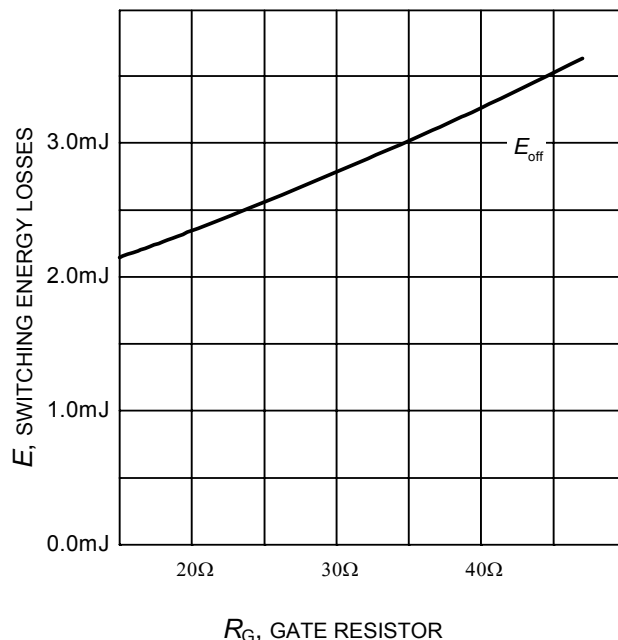


Figure 14. Typical switching energy losses as a function of gate resistor
(inductive load, $T_J=175^\circ\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=30\text{A}$, Dynamic test circuit in Figure E)

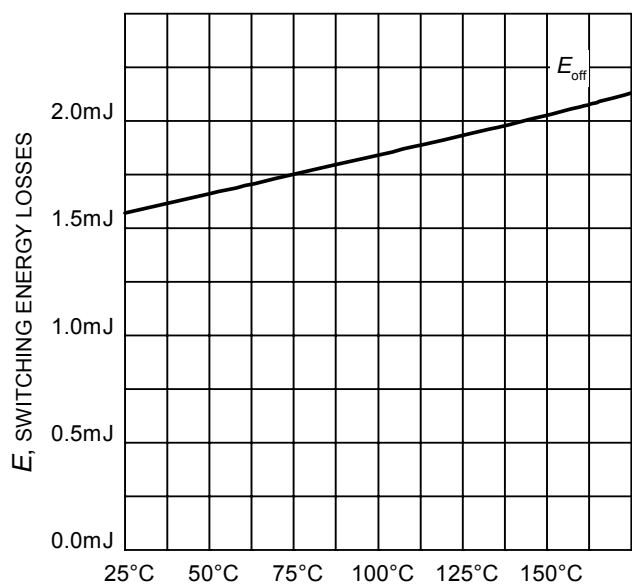


Figure 15. Typical switching energy losses as a function of junction temperature
(inductive load, $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=30\text{A}$, $R_G=15\Omega$, Dynamic test circuit in Figure E)



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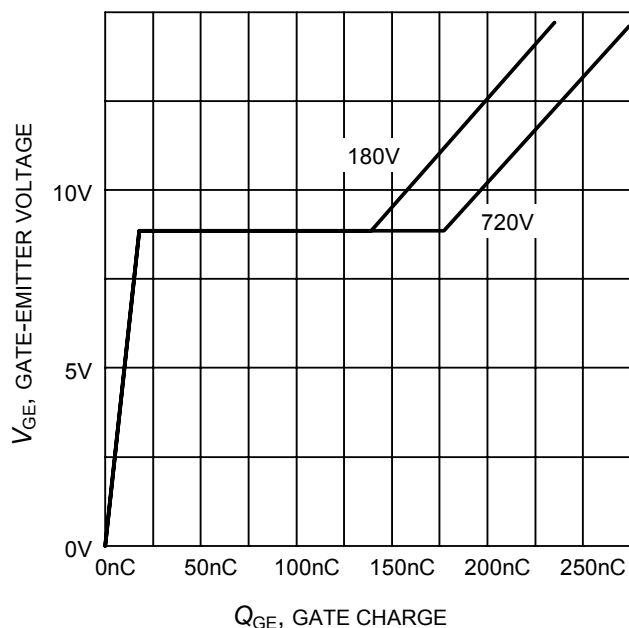


Figure 16. Typical gate charge
($I_C = 30\text{ A}$)

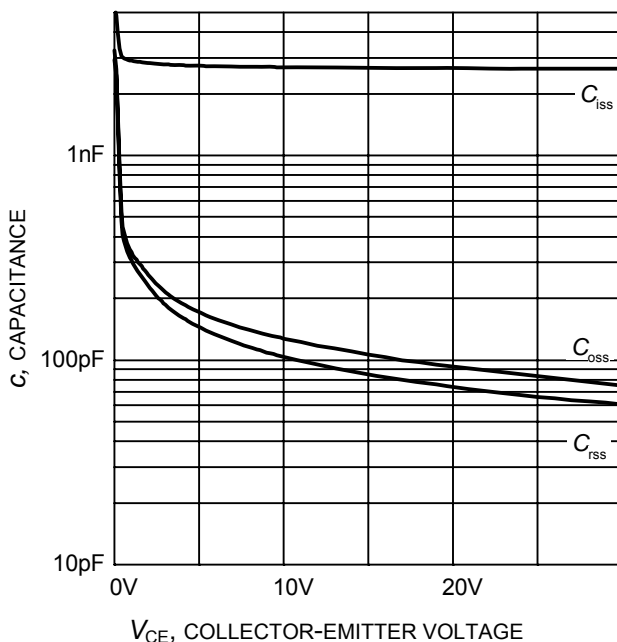


Figure 17. Typical capacitance as a function of collector-emitter voltage
($V_{GE} = 0\text{V}$, $f = 1\text{ MHz}$)

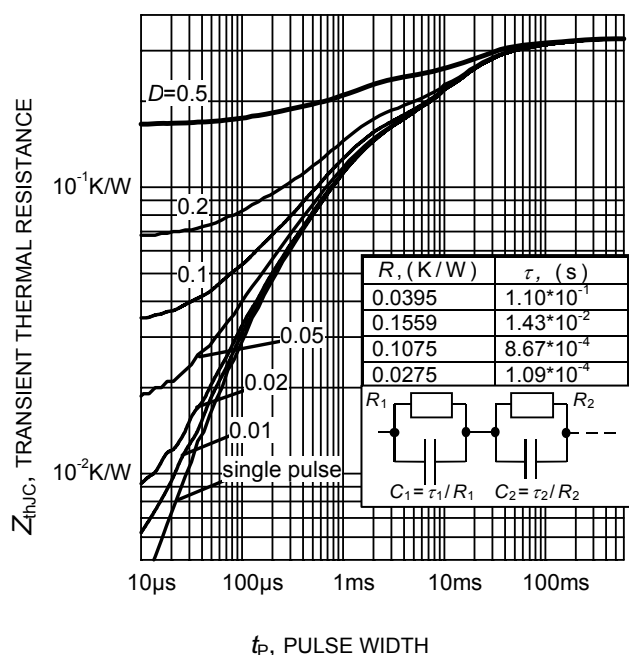


Figure 18. IGBT transient thermal resistance
($D = t_p / T$)

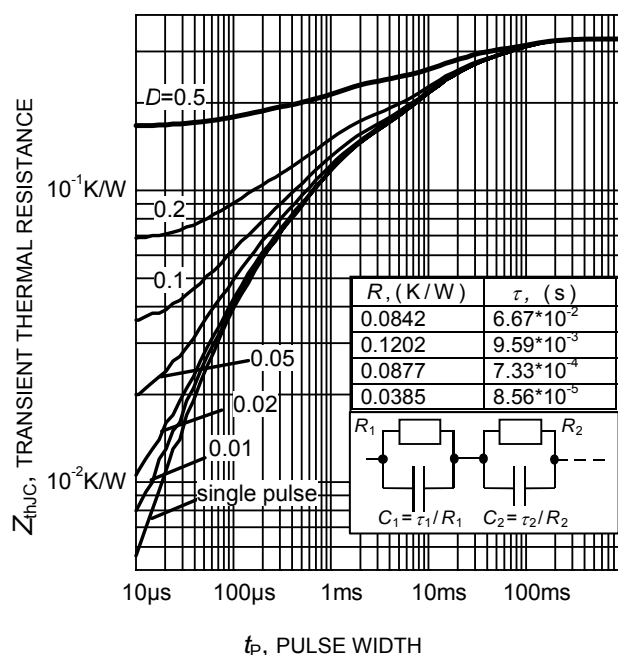


Figure 19. Typical Diode transient thermal impedance as a function of pulse width
($D = t_p / T$)



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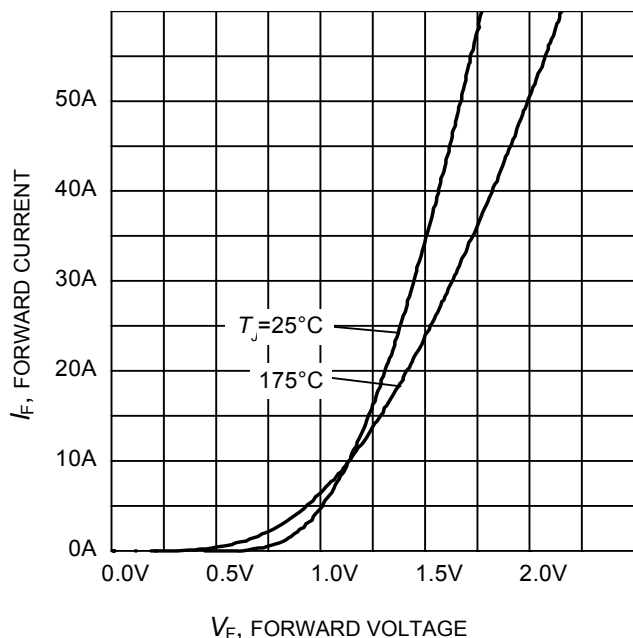


Figure 20. Typical diode forward current as a function of forward voltage

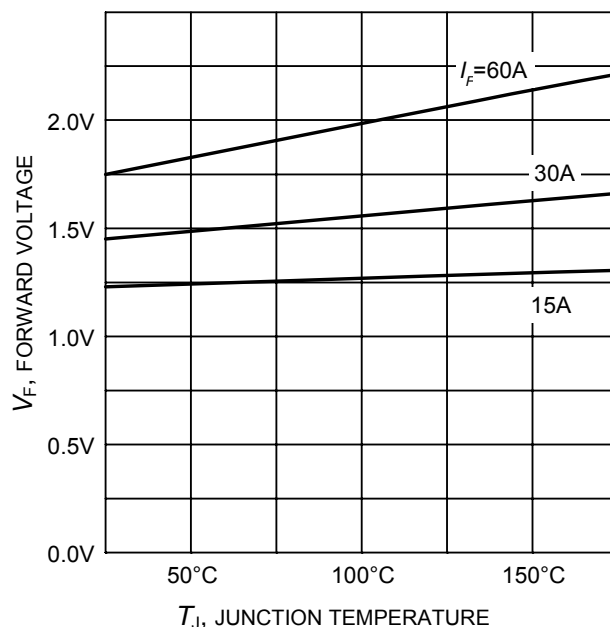


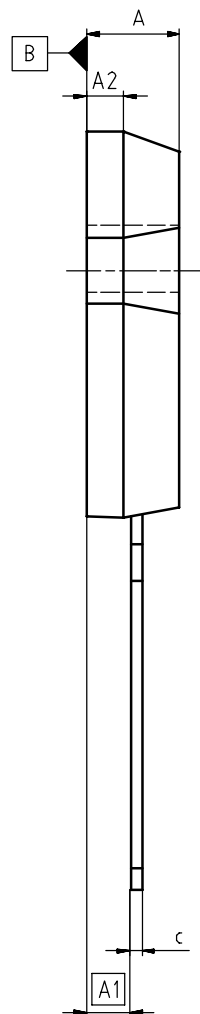
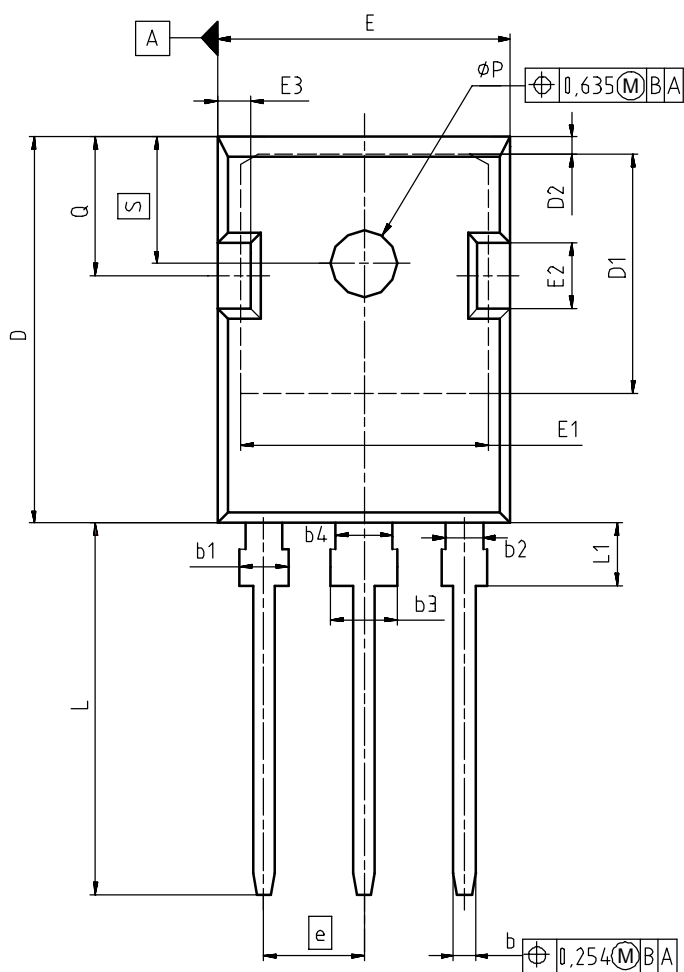
Figure 21. Typical diode forward voltage as a function of junction temperature



Soft Switching Series

IHW30N90R

PG-TO247-3



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

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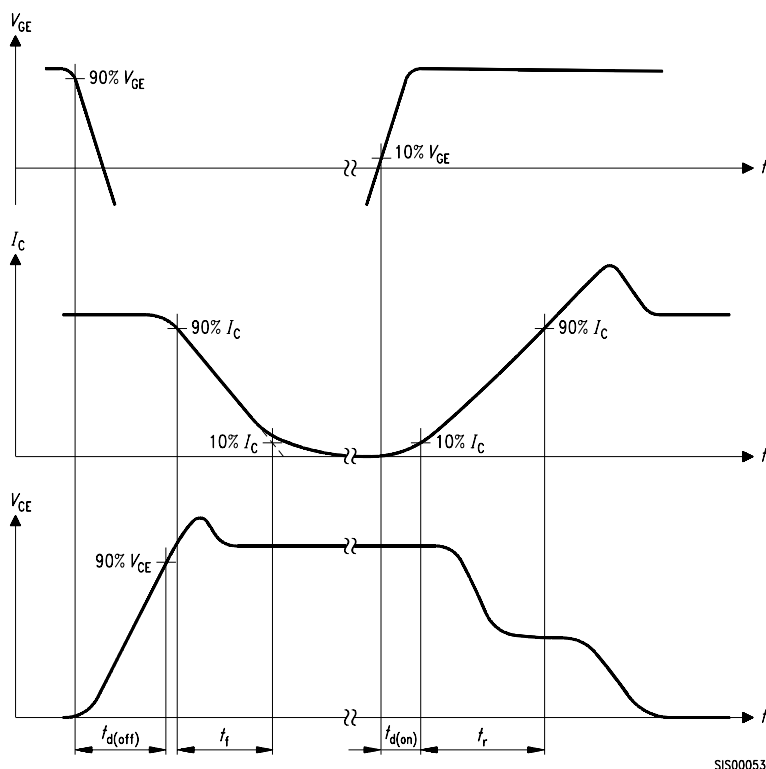


Figure A. Definition of switching times

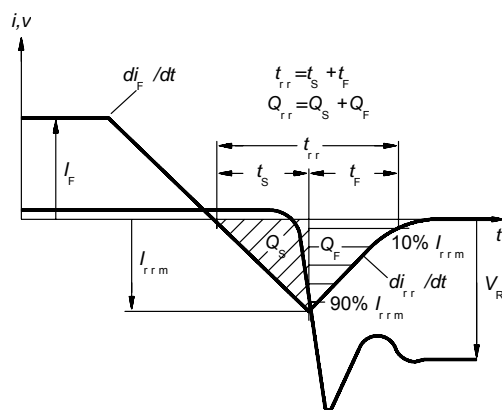


Figure C. Definition of diodes switching characteristics

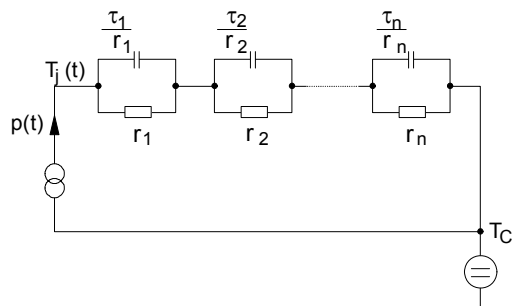


Figure D. Thermal equivalent circuit

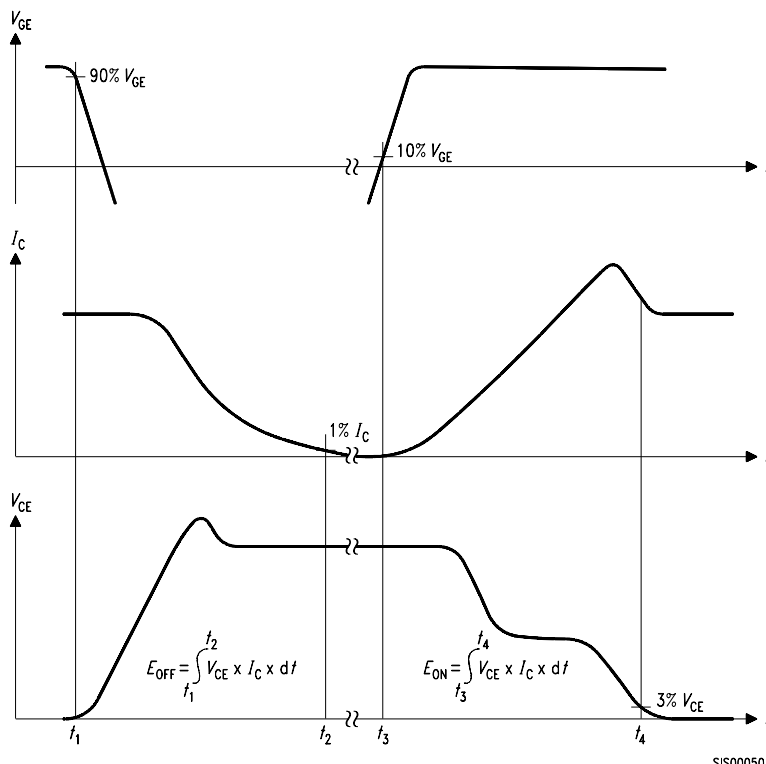


Figure B. Definition of switching losses

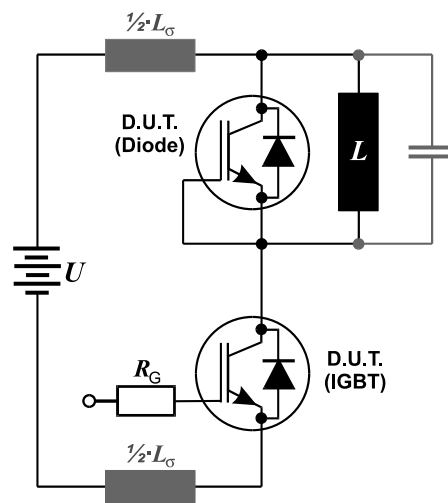


Figure E. Dynamic test circuit



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