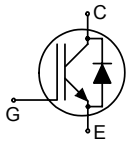
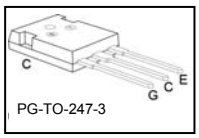
IKW15N120T2

TrenchStop® 2nd generation Series

Low Loss DuoPack : IGBT in 2nd generation **TrenchStop®** technology with soft, fast recovery anti-parallel EmCon diode





- Short circuit withstand time – 10µs
- Designed for :
  - Frequency Converters
  - Uninterrupted Power Supply
- **TrenchStop®** 2nd generation for 1200 V applications offers :
  - very tight parameter distribution
  - high ruggedness, temperature stable behavior
- Easy paralleling capability due to positive temperature coefficient in $V_{CE(sat)}$
- Low EMI
- Low Gate Charge
- Very soft, fast recovery anti-parallel EmCon HE diode
- Qualified according to JEDEC[1] 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	$V_{CE(sat),Tj=25°C}$	$T_{j,max}$	Marking Code	Package
IKW15N120T2	1200V	15A	1.75V	175°C	K15T1202	PG-TO-247-3

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CE}	1200	V
DC collector current (Tj = 150°C)	I_C		A
T_C = 25°C		30	
T_C = 110°C		15	
Pulsed collector current, t_p limited by T_{jmax}	I_{Cpuls}	60	
Turn off safe operating area	-	60	
$V_{CE} \le 1200V$, $T_j \le 175°C$			
Diode forward current (Tj = 150°C)	I_F		
T_C = 25°C		25	
T_C = 110°C		15	
Diode pulsed current, t_p limited by T_{jmax}	I_{Fpuls}	60	
Gate-emitter voltage	V_{GE}	±20	V
Short circuit withstand time[2)]	t_{SC}	10	µs
V_{GE} = 15V, $V_{CC} \le 600V$, $T_{j, start} \le 175°C$			
Power dissipation	P_{tot}	235	W
T_C = 25°C			
Operating junction temperature	T_j	-40...+175	°C
Storage temperature	T_{stg}	-55...+150	
Soldering temperature, 1.6mm (0.063 in.) from case for 10s	-	260	
Wavesoldering only, temperature on leads only			

[1] J-STD-020 and JESD-022
[2)] Allowed number of short circuits: <1000; time between short circuits: >1s.

Thermal Resistance

Parameter	Symbol	Conditions	Max. Value	Unit
Characteristic				
IGBT thermal resistance, junction – case	R_{thJC}		0.63	K/W
Diode thermal resistance, junction – case	R_{thJCD}		1.12	
Thermal resistance, junction – ambient	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=500µA	1200	-	-	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	V_{GE} = 15V, I_C=15A				
		T_j=25°C	-	1.7	2.2	
		T_j=150°C	-	2.1	-	
		T_j=175°C	-	2.2	-	
Diode forward voltage	V_F	V_{GE}=0V, I_F=15A				
		T_j=25°C	-	1.75	2.2	
		T_j=150°C	-	1.8	-	
		T_j=175°C	-	1.75	-	
Gate-emitter threshold voltage	$V_{GE(th)}$	I_C=0.6mA, V_{CE}=V_{GE}	5.2	5.8	6.4	
Zero gate voltage collector current	I_{CES}	V_{CE}=1200V, V_{GE}=0V				mA
		T_j=25°C	-	-	0.4	
		T_j=150°C	-	-	4.0	
		T_j=175°C	-	-	20	
Gate-emitter leakage current	I_{GES}	V_{CE}=0V, V_{GE}=20V	-	-	600	nA
Transconductance	g_{fs}	V_{CE}=20V, I_C=15A	-	8	-	S

Dynamic Characteristic

Input capacitance	C_{iss}	V_{CE}=25V,	-	1000	-	pF
Output capacitance	C_{oss}	V_{GE}=0V,	-	100	-	
Reverse transfer capacitance	C_{rss}	f=1MHz	-	56	-	
Gate charge	Q_{Gate}	V_{CC}=960V, I_C=40A V_{GE}=15V	-	93	-	nC
Internal emitter inductance measured 5mm (0.197 in.) from case	L_E		-	13	-	nH
Short circuit collector current[1)]	$I_{C(SC)}$	V_{GE}=15V, t_{SC}≤10µs V_{CC} = 600V, $T_{j,start}$ = 25°C $T_{j,start}$ = 175°C	-	 82 60	-	A

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,	-	32	-	ns
Rise time	t_r	V_{CC}=600V, I_C=15A,	-	25	-	
Turn-off delay time	$t_{d(off)}$	V_{GE}=0/15V,	-	362	-	
Fall time	t_f	R_G=41.8Ω,	-	95	-	
Turn-on energy	E_{on}	L_σ[2)]=126nH,	-	1.25	-	mJ
Turn-off energy	E_{off}	C_σ[2)]=34pF	-	0.8	-	
Total switching energy	E_{ts}	Energy losses include "tail" and diode reverse recovery.	-	2.05	-	
Anti-Parallel Diode Characteristic						
Diode reverse recovery time	t_{rr}	T_j=25°C,	-	300	-	ns
Diode reverse recovery charge	Q_{rr}	V_R=600V, I_F=15A,	-	1.3		µC
Diode peak reverse recovery current	I_{rrm}	di_F/dt=450A/µs	-	10		A
Diode peak rate of fall of reverse recovery current during t_b	di_{rr}/dt		-	215	-	A/µs

[1)] Allowed number of short circuits: <1000; time between short circuits: >1s.
[2)] Leakage inductance L_σ and Stray capacity C_σ due to dynamic test circuit in Figure E.

Switching Characteristic, Inductive Load, at T_j=175 °C

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
IGBT Characteristic						
Turn-on delay time	$t_{d(on)}$	T_j=175°C V_{CC}=600V, I_C=15A, V_{GE}=0/15V, R_G= 41.8Ω, L_σ [1)]=315nH, C_σ [1)]=34pF Energy losses include "tail" and diode reverse recovery.	-	31	-	ns
Rise time	t_r		-	30	-	
Turn-off delay time	$t_{d(off)}$		-	450	-	
Fall time	t_f		-	176	-	
Turn-on energy	E_{on}		-	1.5	-	mJ
Turn-off energy	E_{off}		-	1.3	-	
Total switching energy	E_{ts}		-	2.8	-	
Anti-Parallel Diode Characteristic						
Diode reverse recovery time	t_{rr}	T_j=175°C V_R=600V, I_F=15A, di_F/dt=460A/µs	-	460	-	ns
Diode reverse recovery charge	Q_{rr}		-	2.65	-	µC
Diode peak reverse recovery current	I_{rrm}		-	13	-	A
Diode peak rate of fall of reverse recovery current during t_b	di_{rr}/dt		-	123		A/µs

[1)] Leakage inductance L_σ and Stray capacity C_σ due to dynamic test circuit in Figure E.

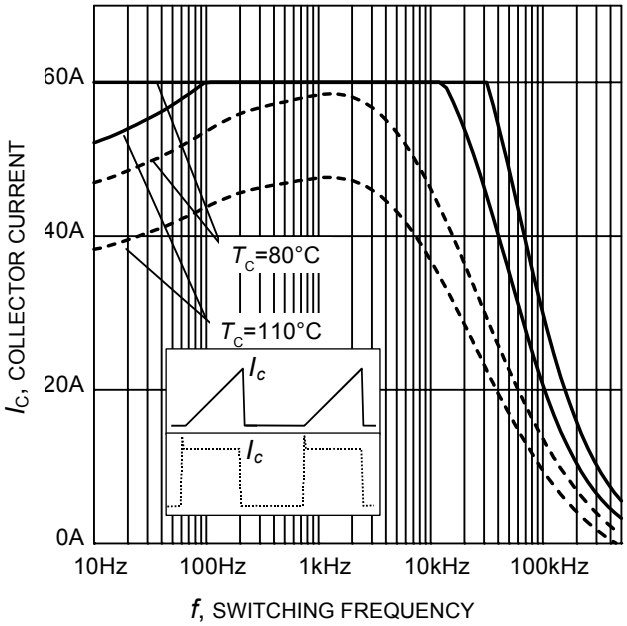


Figure 1. Collector current as a function of switching frequency
($T_j \le 175°C$, $D = 0.5$, $V_{CE} = 600V$, $V_{GE} = 0/+15V$, $R_G = 41.8\Omega$)

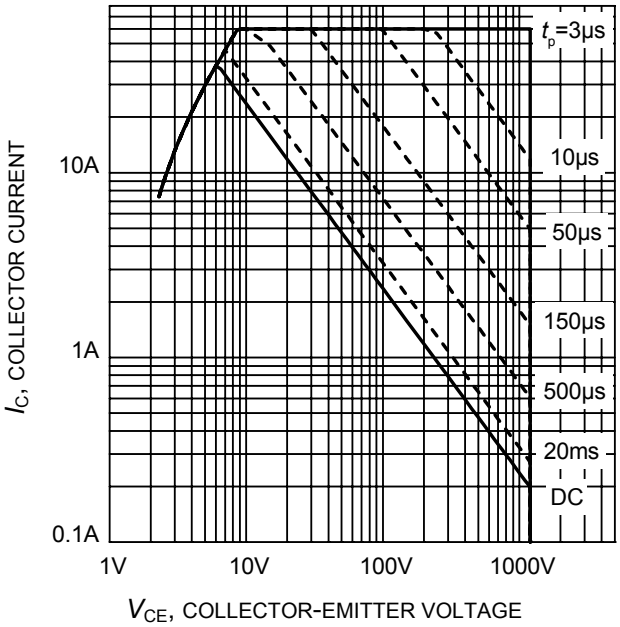


Figure 2. Safe operating area
($D = 0$, $T_C = 25°C$, $T_j \le 175°C$; V_{GE}=15V)

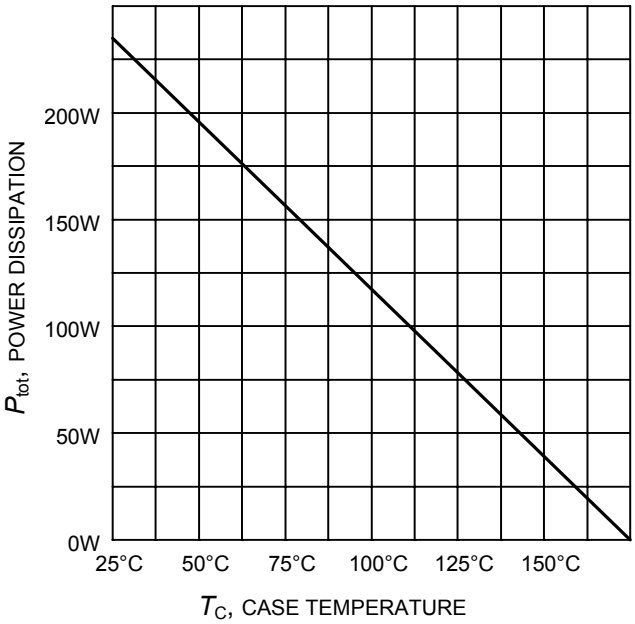


Figure 3. Maximum power dissipation as a function of case temperature
($T_j \le 175°C$)

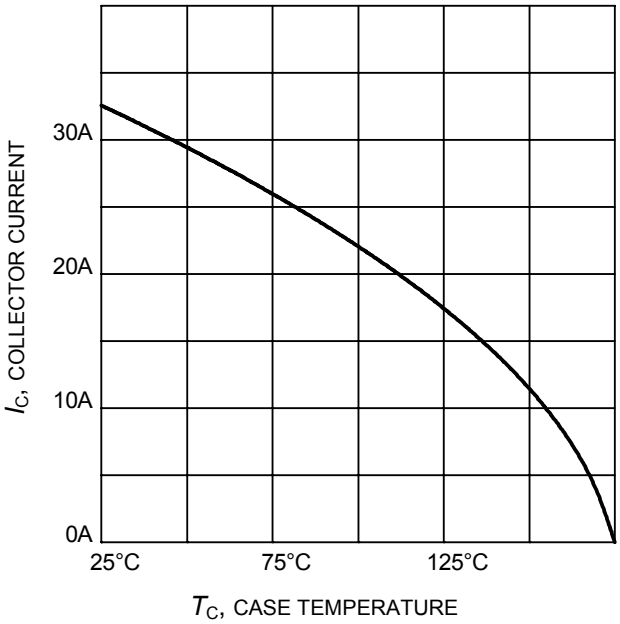


Figure 4. Maximum DC Collector current as a function of case temperature
($V_{GE} \ge 15V$, $T_j \le 175°C$)

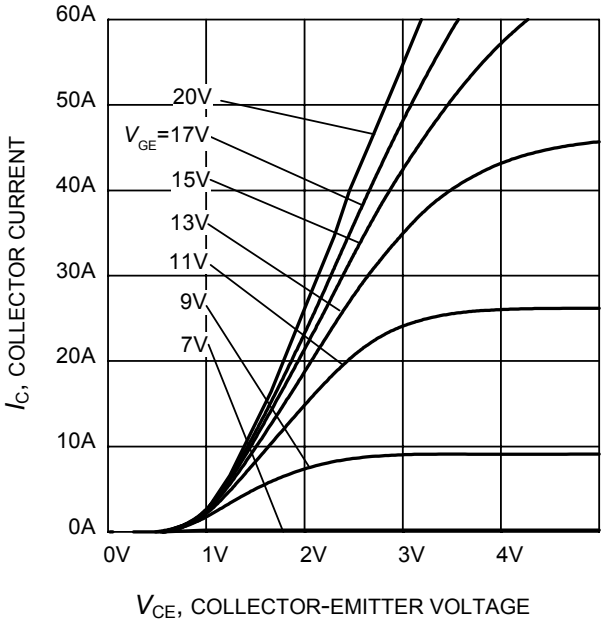


Figure 5. Typical output characteristic
(T_j = 25°C)

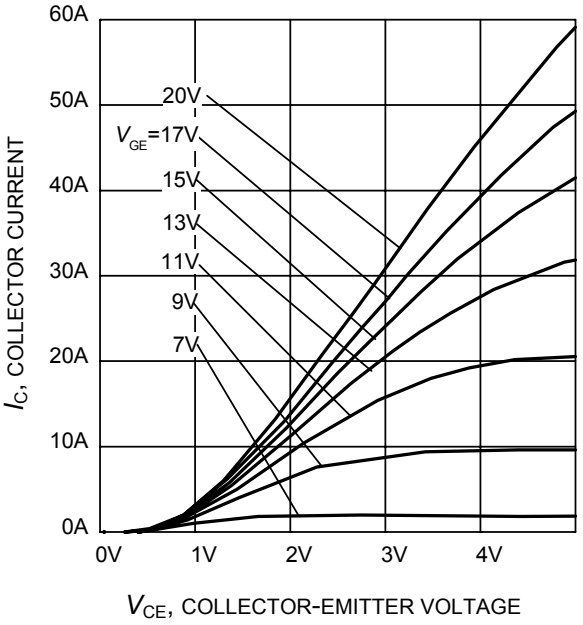


Figure 6. Typical output characteristic
(T_j = 175°C)

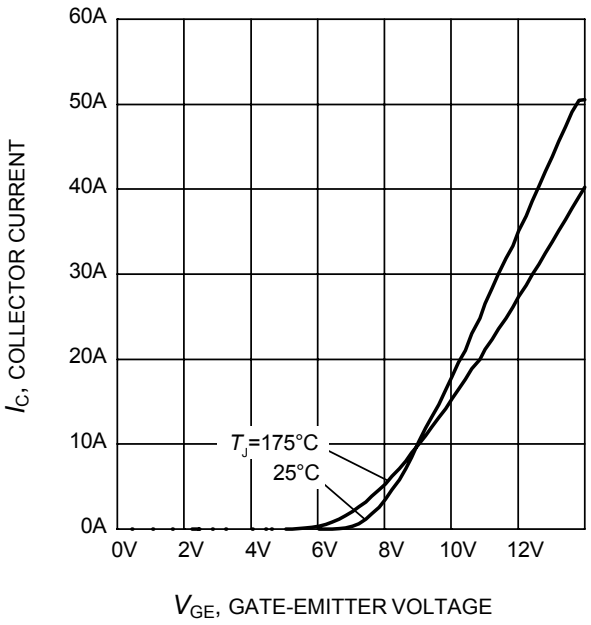


Figure 7. Typical transfer characteristic
(V_{CE}=20V)

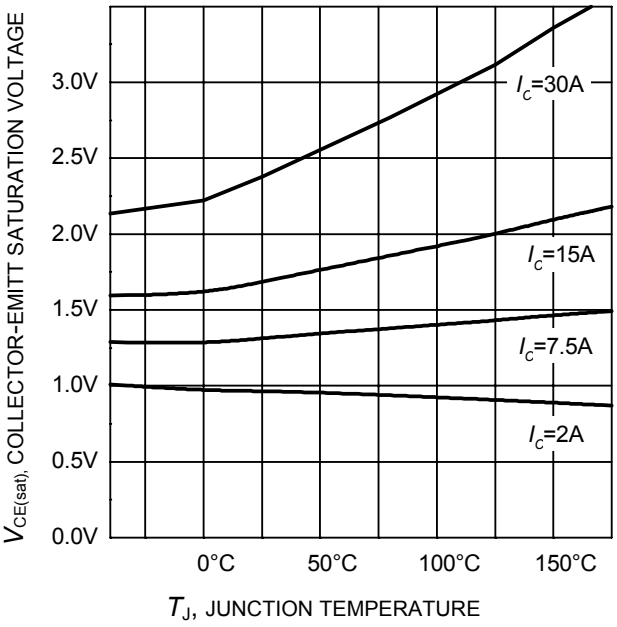


Figure 8. Typical collector-emitter saturation voltage as a function of junction temperature
(V_{GE} = 15V)

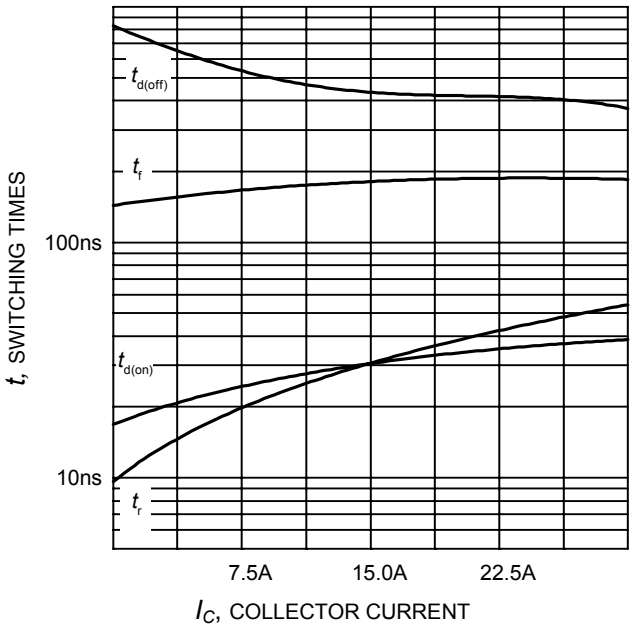


Figure 9. Typical switching times as a function of collector current
(inductive load, T_J=175°C, V_{CE}=600V, V_{GE}=0/15V, R_G=41.8Ω, Dynamic test circuit in Figure E)

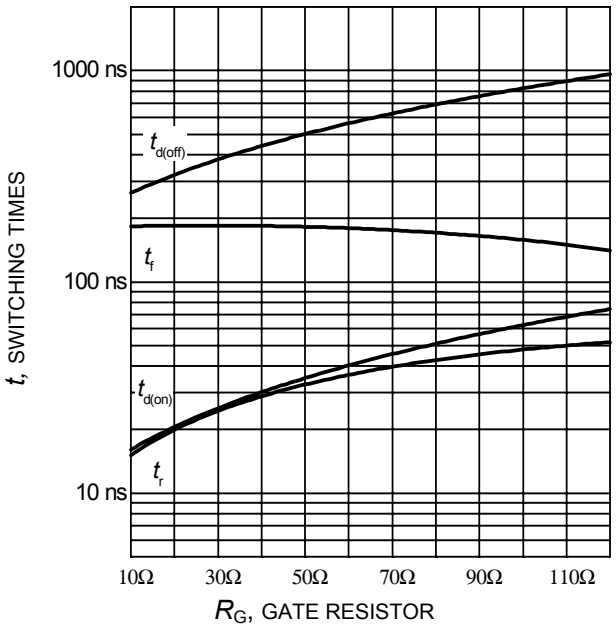


Figure 10. Typical switching times as a function of gate resistor
(inductive load, T_J=175°C, V_{CE}=600V, V_{GE}=0/15V, I_C=15A, Dynamic test circuit in Figure E)

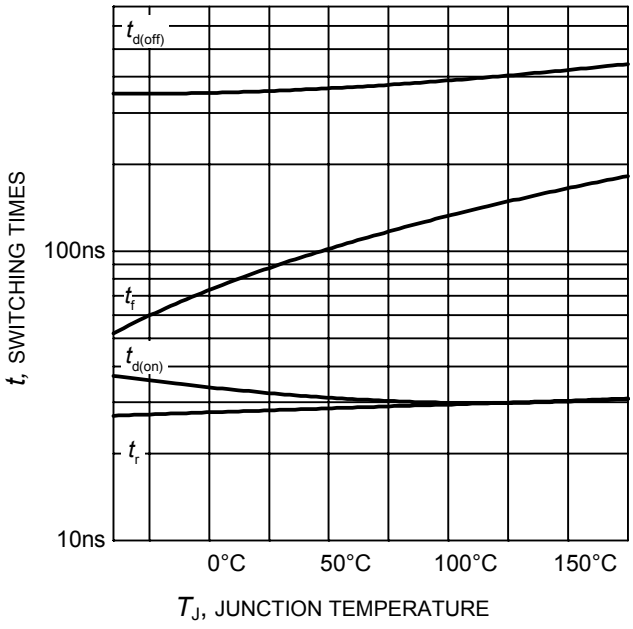


Figure 11. Typical switching times as a function of junction temperature
(inductive load, V_{CE}=600V, V_{GE}=0/15V, I_C=15A, R_G=41.8Ω, Dynamic test circuit in Figure E)

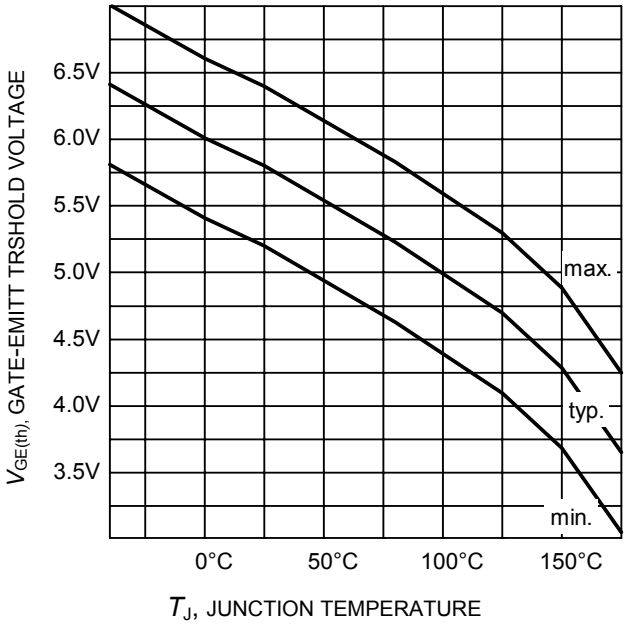


Figure 12. Gate-emitter threshold voltage as a function of junction temperature
(I_C = 600µA)

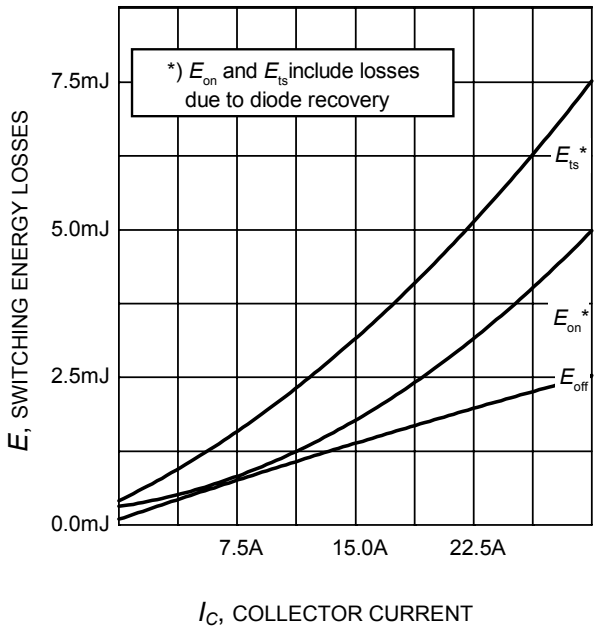


Figure 13. Typical switching energy losses as a function of collector current
(inductive load, T_J=175°C, V_{CE}=600V, V_{GE}=0/15V, R_G=41.8Ω, Dynamic test circuit in Figure E)

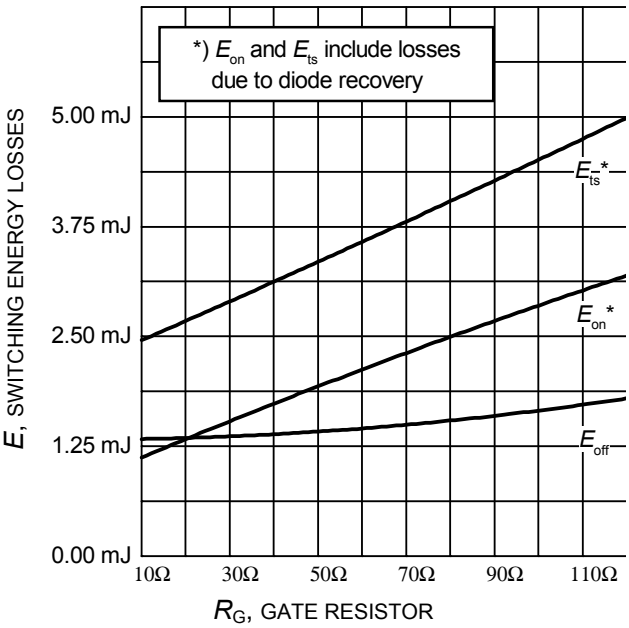


Figure 14. Typical switching energy losses as a function of gate resistor
(inductive load, T_J=175°C, V_{CE}=600V, V_{GE}=0/15V, I_C=15A, Dynamic test circuit in Figure E)

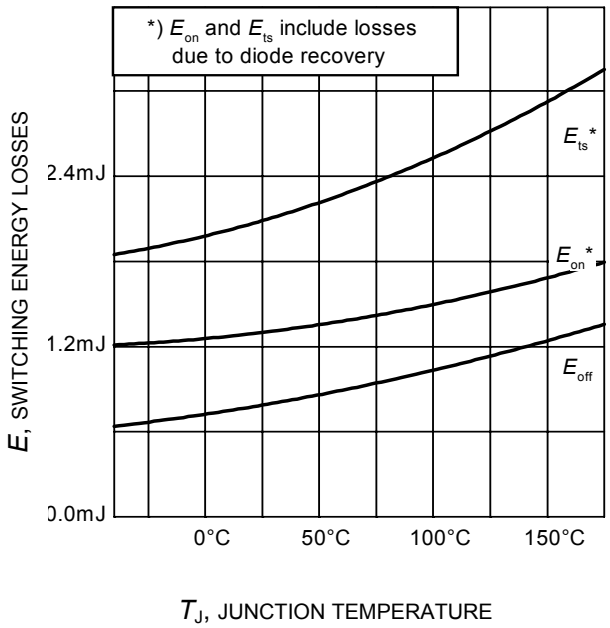


Figure 15. Typical switching energy losses as a function of junction temperature
(inductive load, V_{CE}=600V, V_{GE}=0/15V, I_C=15A, R_G=41.8Ω, Dynamic test circuit in Figure E)

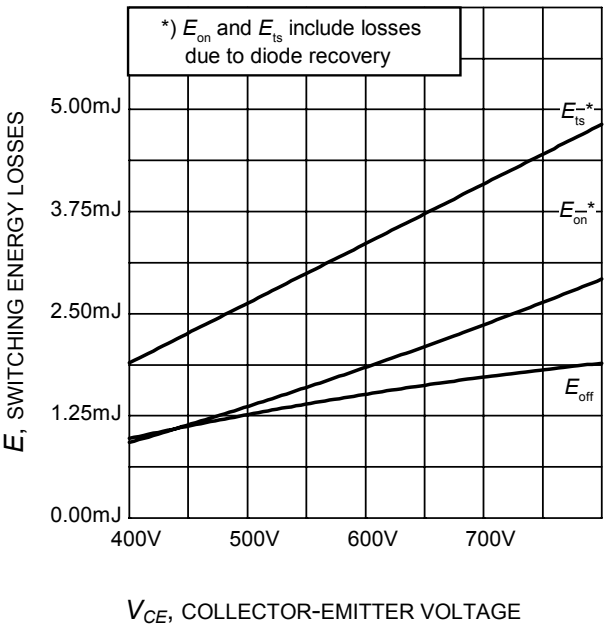


Figure 16. Typical switching energy losses as a function of collector emitter voltage
(inductive load, T_J=175°C, V_{GE}=0/15V, I_C=15A, R_G=41.8Ω, Dynamic test circuit in Figure E)

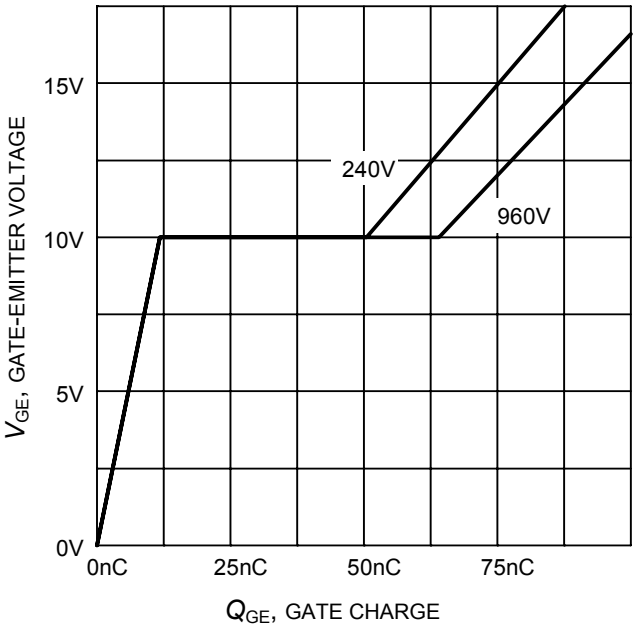


Figure 17. Typical gate charge
(I_C=15 A)

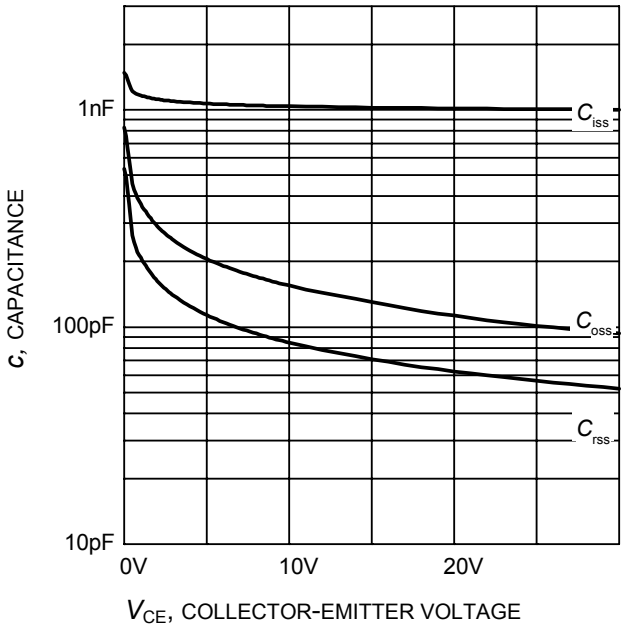


Figure 18. Typical capacitance as a function of collector-emitter voltage
(V_{GE}=0V, f = 1 MHz)

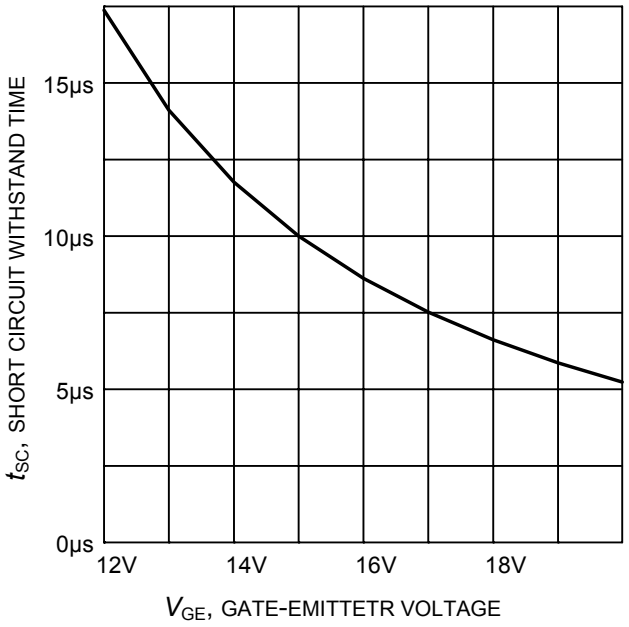


Figure 19. Short circuit withstand time as a function of gate-emitter voltage
(V_{CE}=600V, start at T_J≤175°C)

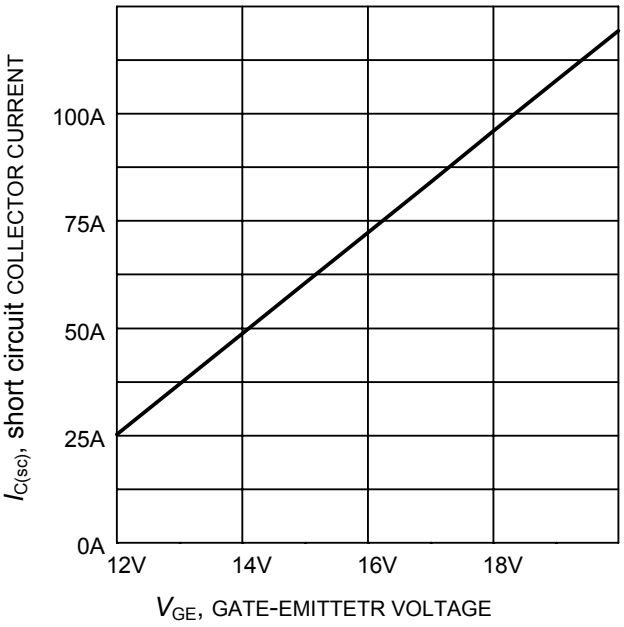


Figure 20. Typical short circuit collector current as a function of gate-emitter voltage
(V_{CE} ≤ 600V, $T_{j,start}$ =175°C)

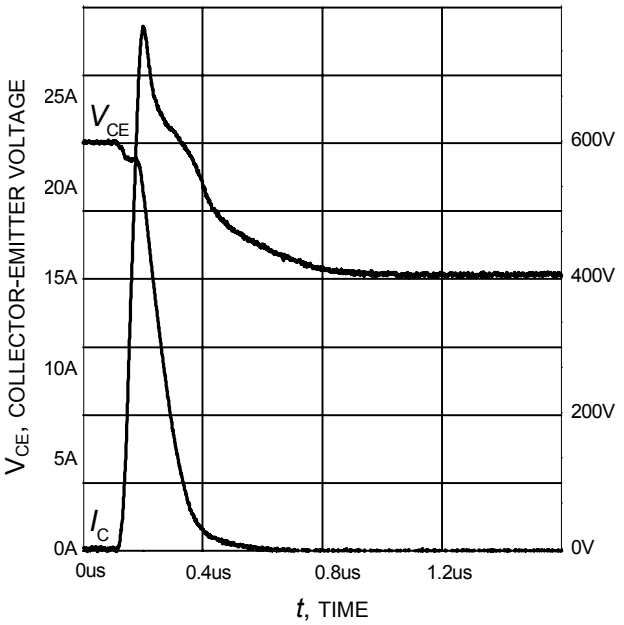


Figure 21. Typical turn on behavior
(V_{GE}=0/15V, R_G=41.8Ω, T_j = 175°C,
Dynamic test circuit in Figure E)

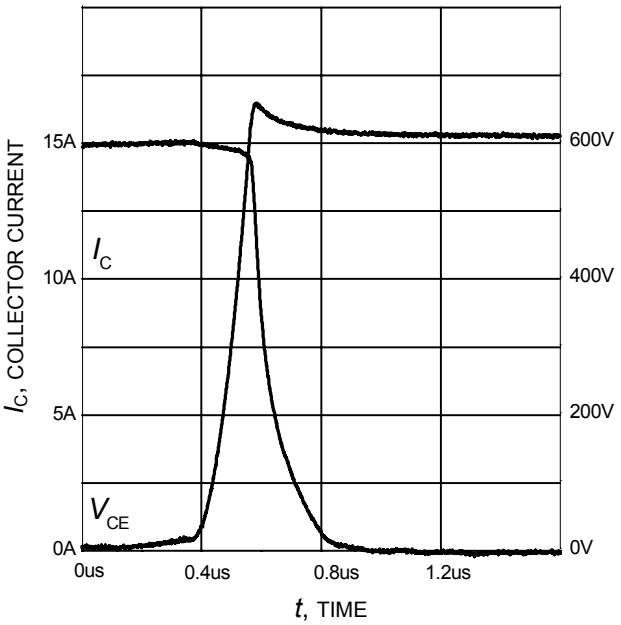


Figure 22. Typical turn off behavior
(V_{GE}=15/0V, R_G=41.8Ω, T_j = 175°C,
Dynamic test circuit in Figure E)

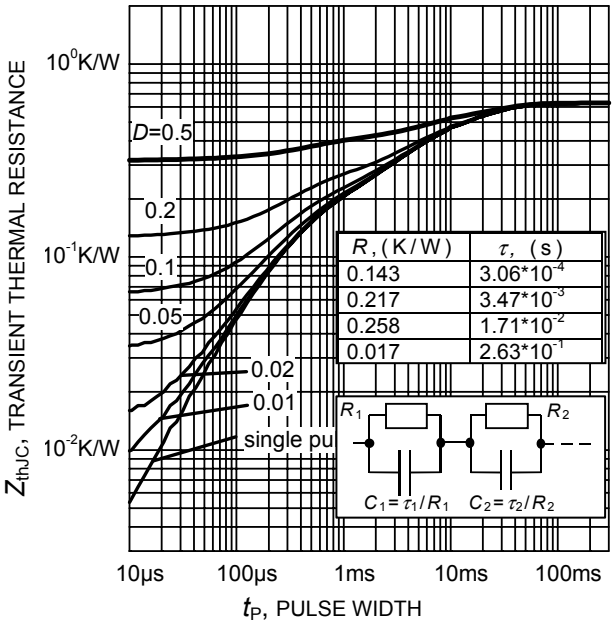


Figure 23. IGBT transient thermal resistance
($D = t_p / T$)

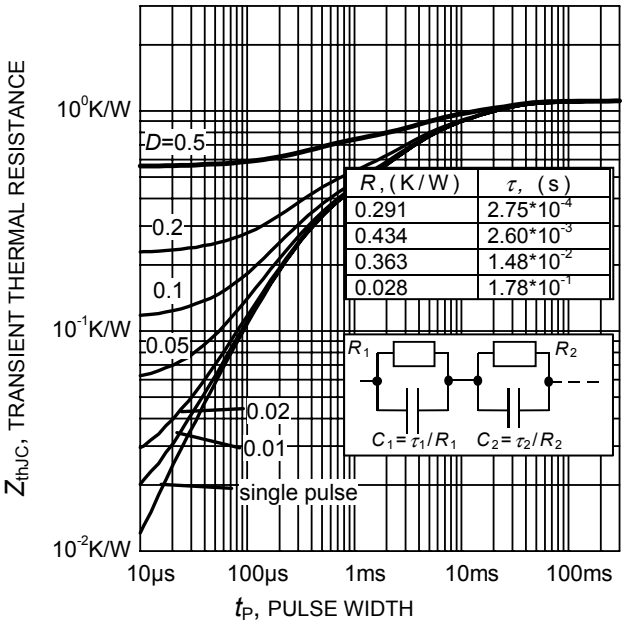


Figure 24. Diode transient thermal impedance as a function of pulse width
($D=t_P/T$)

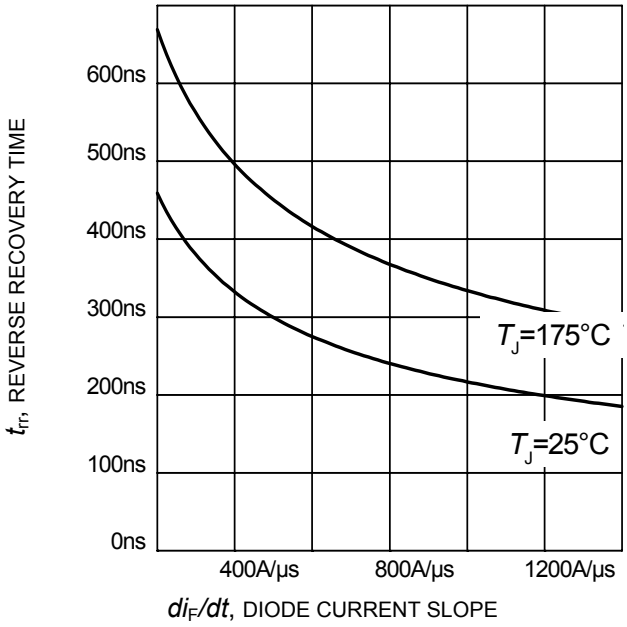


Figure 23. Typical reverse recovery time as a function of diode current slope
(V_R=600V, I_F=15A,
Dynamic test circuit in Figure E)

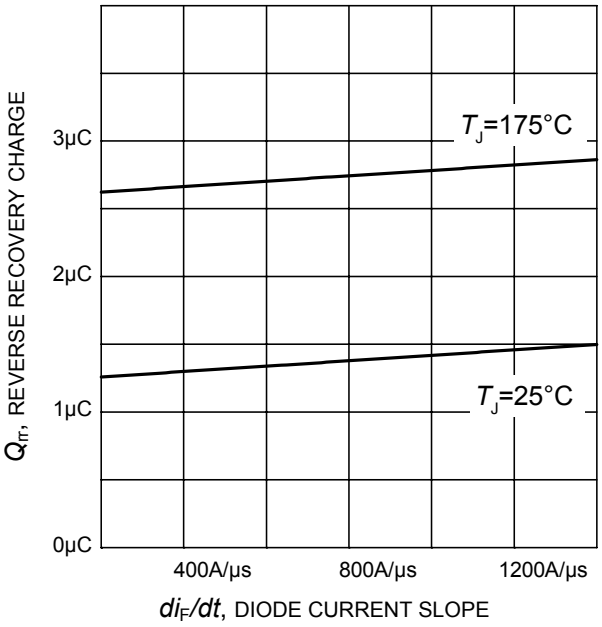


Figure 24. Typical reverse recovery charge as a function of diode current slope
(V_R=600V, I_F=15A,
Dynamic test circuit in Figure E)

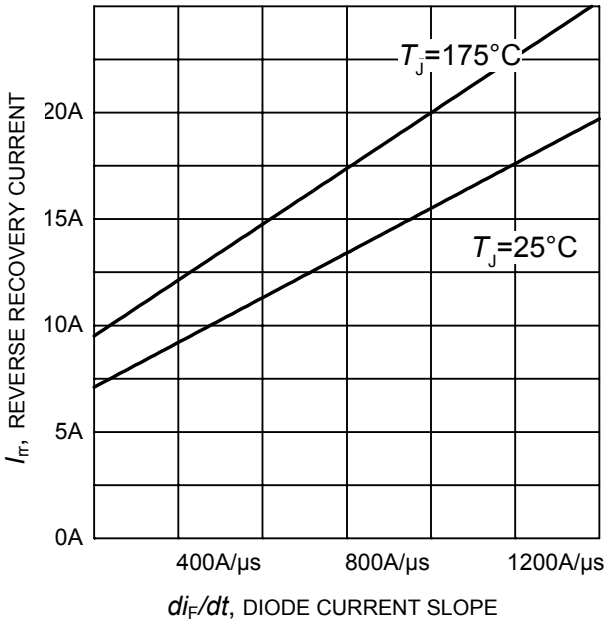


Figure 25. Typical reverse recovery current as a function of diode current slope
(V_R=600V, I_F=15A,
Dynamic test circuit in Figure E)

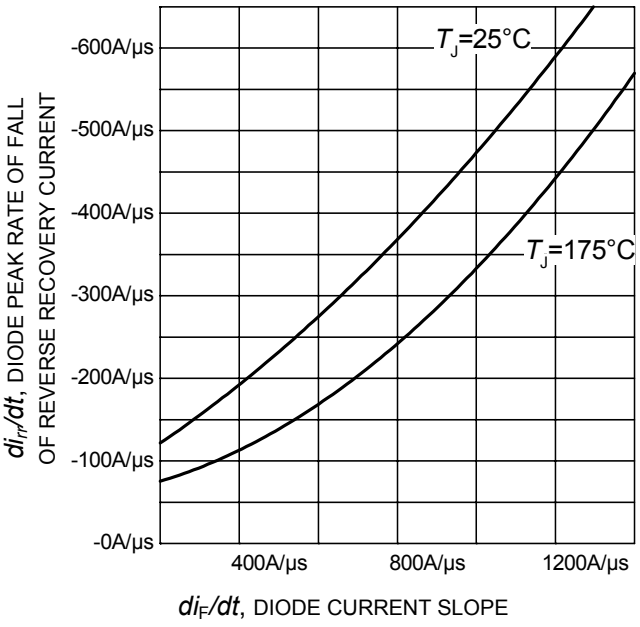


Figure 26. Typical diode peak rate of fall of reverse recovery current as a function of diode current slope
(V_R=600V, I_F=15A,
Dynamic test circuit in Figure E)

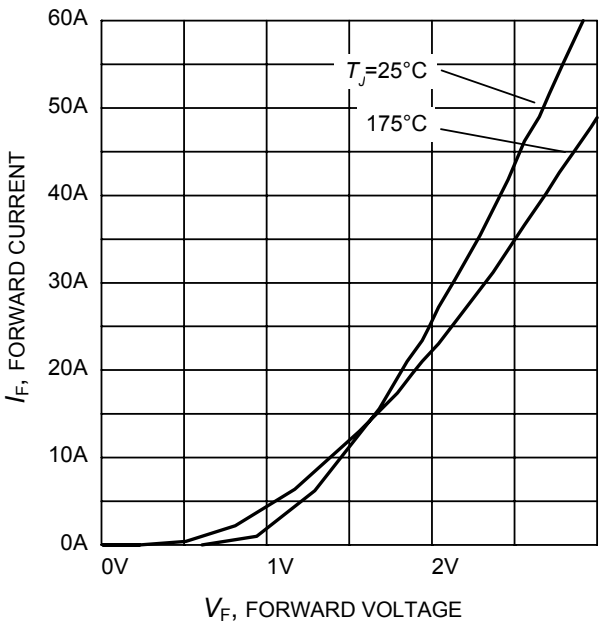


Figure 27. Typical diode forward current as a function of forward voltage

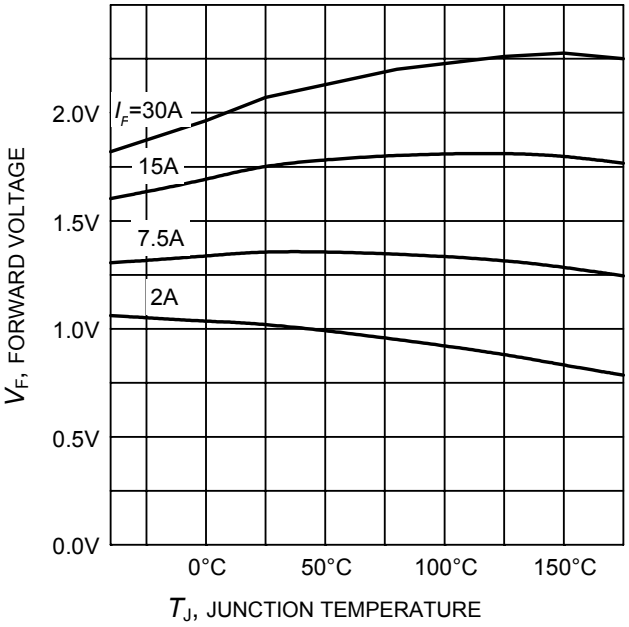


Figure 28. Typical diode forward voltage as a function of junction temperature

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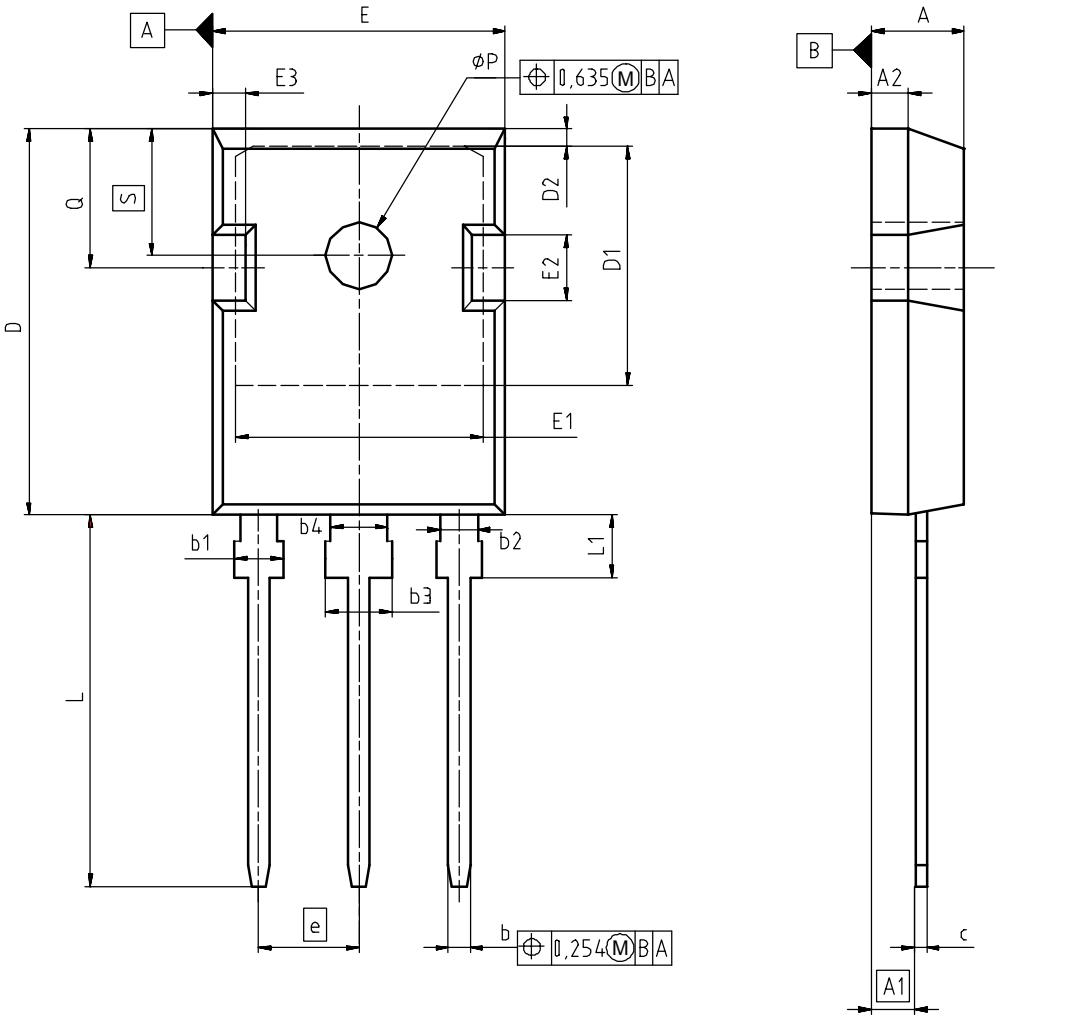

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.90	5.16	0.193	0.203
A1	2.27	2.53	0.089	0.099
A2	1.85	2.11	0.073	0.083
b	1.07	1.33	0.042	0.052
b1	1.90	2.41	0.075	0.095
b2	1.90	2.16	0.075	0.085
b3	2.87	3.38	0.113	0.133
b4	2.87	3.13	0.113	0.123
c	0.55	0.68	0.022	0.027
D	20.82	21.10	0.820	0.831
D1	16.25	17.65	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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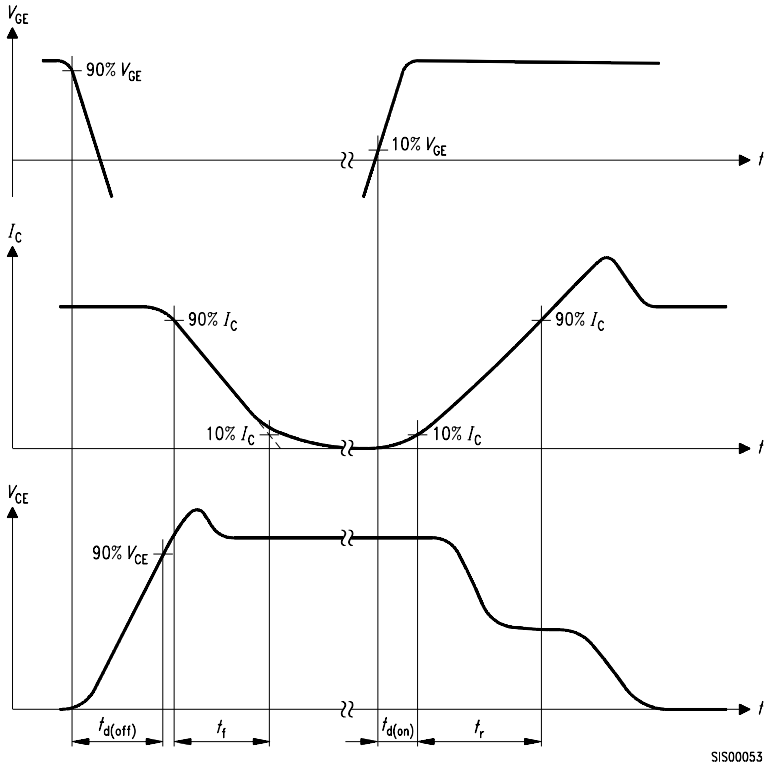

Figure A. Definition of switching times

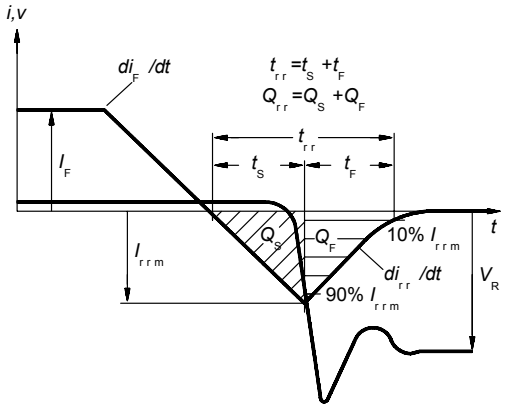

Figure C. Definition of diodes switching characteristics

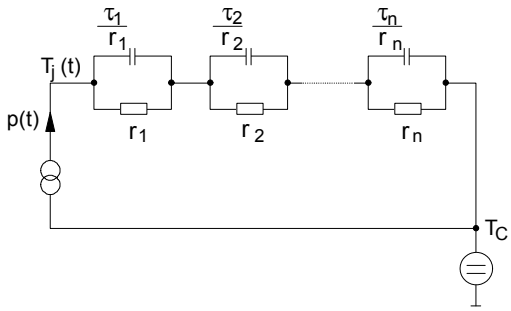

Figure D. Thermal equivalent circuit

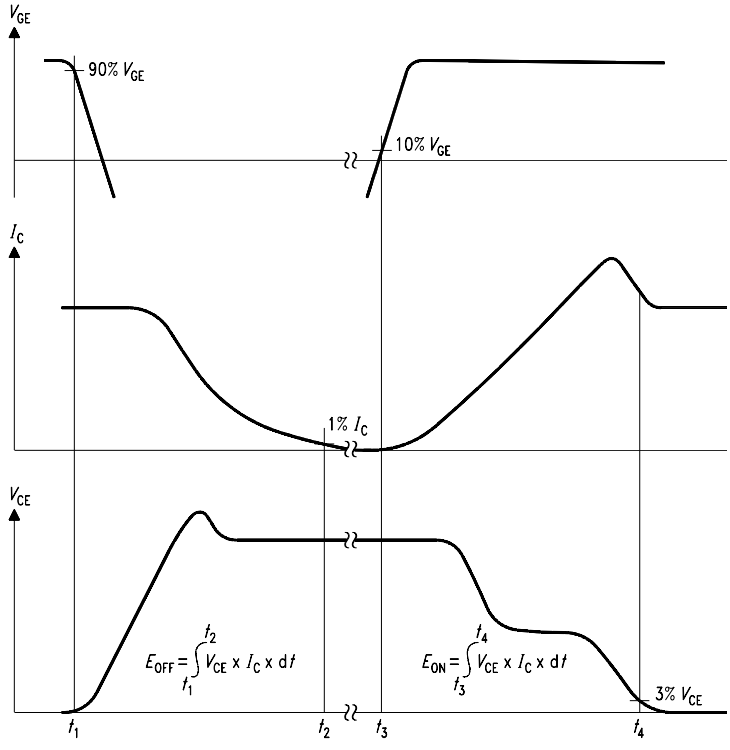

Figure B. Definition of switching losses

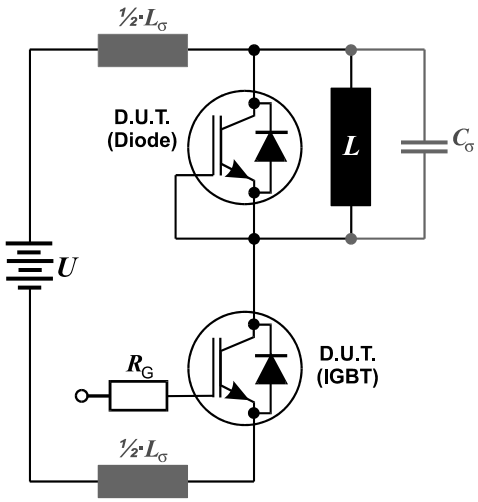

Figure E. Dynamic test circuit

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