

IKD04N60R-VB Datasheet

600V Trench and Fieldstop IGBT

PRODUCT SUMMARY		
V _{CE} (V)	600	
I _C (A)	14 (TC=25 °C)	7 (TC=100 °C)
V _{CE (sat)} (V)	1.6	
I _{CM} (A)	21	

FEATURES

- Very Low V_{CEsat}
- Low turn-off losses
- High speed switching
- Maximum junction temperature 175°C
- Ultra low gate charge (Q_g)
- Avalanche energy rated (UIS)



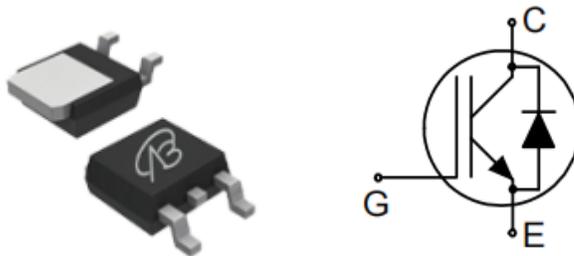
APPLICATIONS

- Telecommunications
 - Server and telecom power supplies
- Lighting
 - High-intensity discharge (HID)
 - Fluorescent ballast lighting
- Consumer and computing
 - ATX power supplies
- Industrial
 - Welding
 - Battery chargers
- Renewable energy
 - Solar (PV inverters)
- Switch mode power supplies (SMPS)

Package pin definition

- Pin1 G - Gate
- Pin2 C & backside - Collector
- Pin3 E - Emitter

TO-252



Top View

ABSOLUTE MAXIMUM RATINGS (T _C = 25 °C, unless otherwise noted)					
PARAMETER		SYMBOL	LIMIT	UNIT	
Collector-Emitter Voltage		V _{CE}	600	V	
Gate-Emitter Voltage		V _{GE}	±30		
Continuous Collector Current (T _J = 150 °C)	V _{GE} at 15 V	I _C	T _C = 25 °C	14	A
			T _C = 100 °C	7	
Pulsed Collector Current ^a		I _{CM}	21		
Diode Forward Current ^b		I _F	7	A	
Maximum Power Dissipation		P _D	T _C = 25 °C	55	W
			T _C = 100 °C	43	W
Operating Junction and Storage Temperature Range		T _J , T _{stg}	-55 to +175	°C	
Short Circuit Withstand Time ^{TC=150}	V _{GE} = 15V, V _{CE} 400V	tsc	3	µs	
Short Circuit Withstand Time ^{TC=100}	V _{GE} = 15V, V _{CE} 330V		5		
Soldering Recommendations (Peak Temperature) ^c	for 10 s		260	°C	

Notes

- Repetitive rating; pulse width limited by maximum junction temperature.
- Current limited by maximum junction temperature.
- 1.6 mm from case.

THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	R_{thJA}	-	40	°C/W
Maximum Junction-to-Case	R_{thJC}	-	1.5	

SPECIFICATIONS ($T_J = 25\text{ °C}$, unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Collector-Emitter Breakdown Voltage	BV_{CE}	$V_{GE} = 0\text{ V}, I_C = 250\text{ }\mu\text{A}$ $V_{GE} = 0\text{ V}, I_C = 1\text{ mA}$		600 600	- -	- -	V
Gate-Source Threshold Voltage (N)	$V_{GE(th)}$	$V_{CE} = V_{GE}, I_D = 250\text{ }\mu\text{A}$		4	5	6	V
Zero Gate Voltage Collector Current	I_{CES}	$V_{CE} = 600\text{ V}, V_{GE} = 0\text{ V}, T_J = 25\text{ °C}$		-	1	20	μA
		$V_{CE} = 600\text{ V}, V_{GE} = 0\text{ V}, T_J = 150\text{ °C}$		-	1000	-	μA
Gate-Emitter Leakage Current	I_{GES}	$V_{CE} = 0\text{ V}, V_{GS} = \pm 2.0\text{ V}$		-	-	100	nA
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$V_{GE} = 15\text{ V}$	$I_C = 7\text{ A}$	-	1.7	2.1	V
Forward Transconductance	g_{fs}	$V_{CE} = 20\text{ V}, I_C = 7\text{ A}$		-	40	-	S
Dynamic							
Input Capacitance	C_{ies}	$V_{GE} = 0\text{ V}, V_{CE} = 25\text{ V},$ $f = 500\text{ KHz}$		-	1400	-	pF
Output Capacitance	C_{oes}			-	76	-	
Reverse Transfer Capacitance	C_{res}			-	21	-	
Turn-on Energy	E_{on}	$V_{CE} = 400\text{ V}, V_{GE} = 0/15\text{V},$ $I_C = 7\text{ A}, R_g = 10\Omega$		-	0.81	-	nJ
Turn-off Energy	E_{off}			-	0.26	-	
Total Gate Charge	Q_g	$V_{GE} = 15\text{ V}$	$I_C = 7\text{ A}, V_{CE} = 400\text{ V}$	-	18	-	nC
Gate-Emitter Charge	Q_{ge}			-	15	-	
Gate to Collector Charge	Q_{gc}			-	33	-	
Turn-On Delay Time	$t_{d(on)}$	$V_{CE} = 400\text{ V}, V_{GE} = 0/15\text{V},$ $I_C = 7\text{ A}, R_g = 10\Omega$		-	45	-	ns
Rise Time	t_r			-	25	-	
Turn-Off Delay Time	$t_{d(off)}$			-	115	-	
Fall Time	t_f			-	24	-	
Internal emitter inductance measured 5 mm	L_E			-	13	-	nH
Diode Characteristics							
Diode Forward Current	I_F	IGBT symbol showing the integral reverse junction diode		-	-	7	A
Pulsed Diode Forward Current	I_{FM}			-	-	21	
Diode Forward Voltage	V_F	$I_F = 7\text{ A}$		-	1.75	2.0	V
Reverse Recovery Time	t_{rr}	$T_J = 25\text{ °C}, I_F = 7\text{ A},$ $di_F/dt = 200\text{ A}/\mu\text{s}, V_R = 400\text{ V}$		-	70	-	ns
Reverse Recovery Charge	Q_{rr}			-	0.26	-	μC
Reverse Recovery Current	I_{RRM}			-	9	-	A

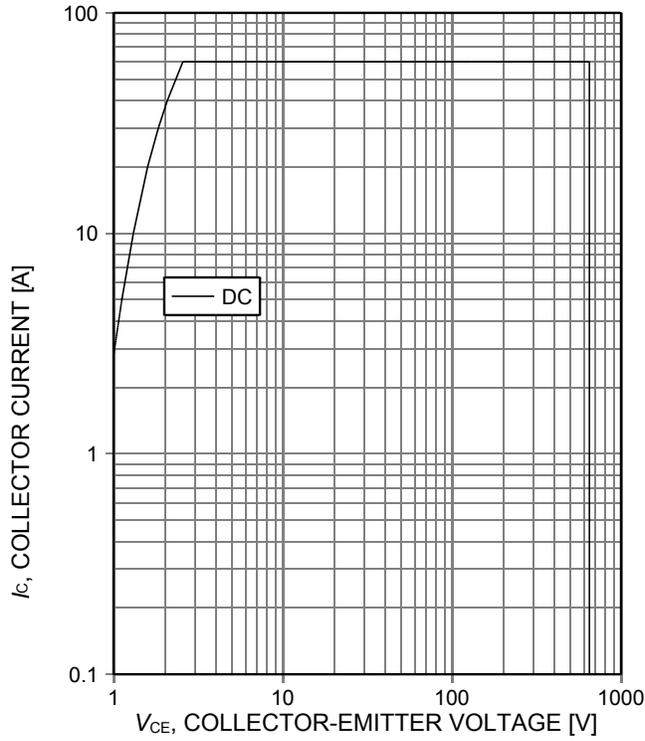


Figure 1. **Forward bias safe operating area**
($D=0$, $T_C=25^\circ\text{C}$, $T_{vj}\leq 175^\circ\text{C}$; $V_{GE}=15\text{V}$.
Recommended use at $V_{GE}\geq 7.5\text{V}$)

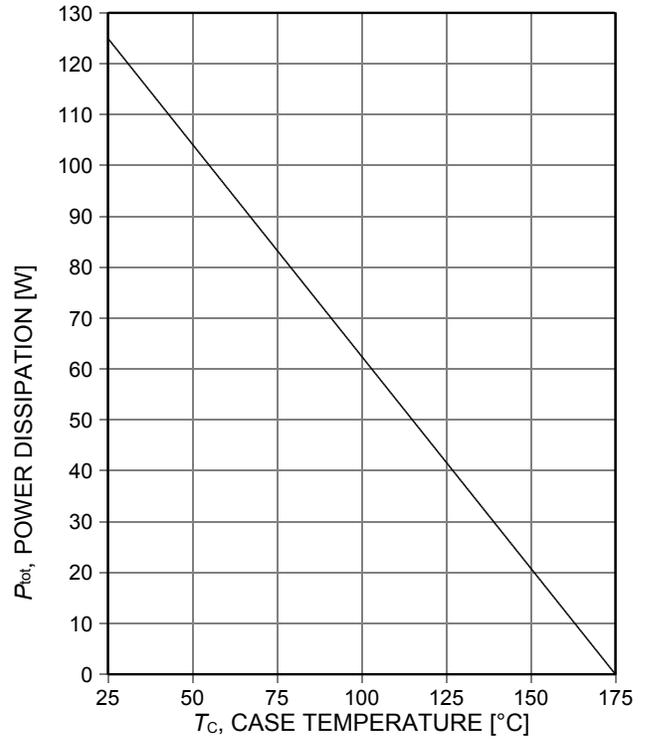


Figure 2. **Power dissipation as a function of case temperature**
($T_{vj}\leq 175^\circ\text{C}$)

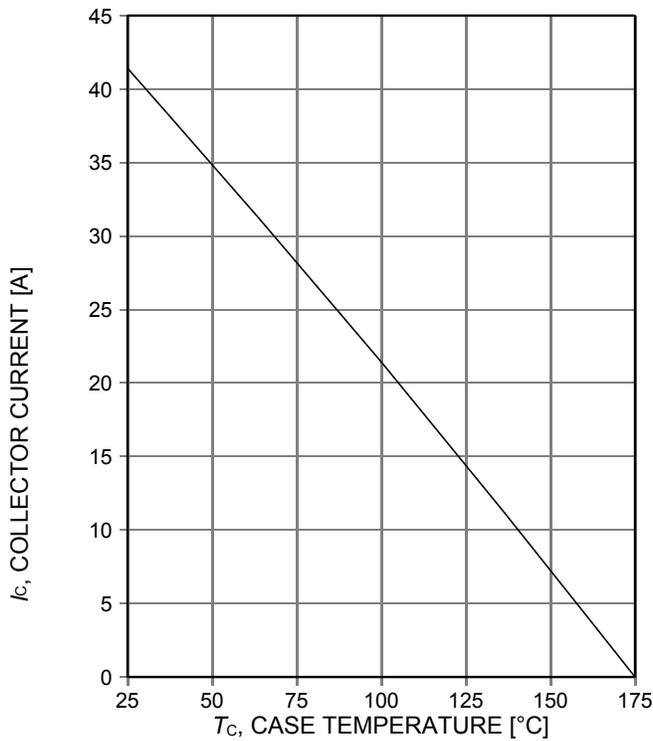


Figure 3. **Collector current as a function of case temperature**

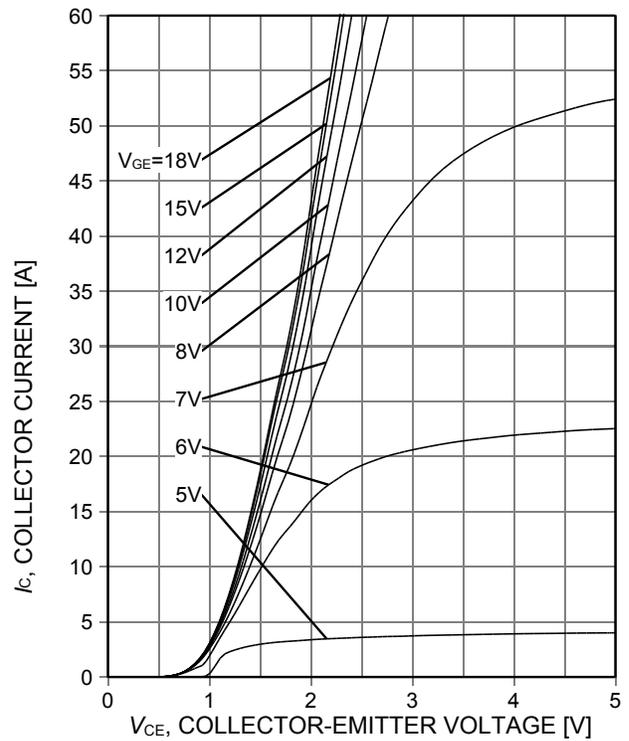


Figure 4. **Typical output characteristic**

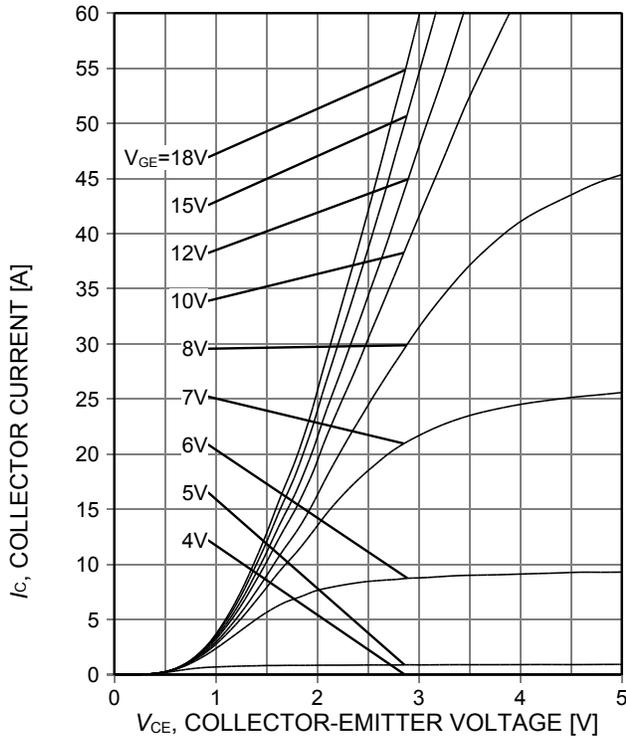


Figure 5. Typical output characteristic ($T_{vj}=150^{\circ}\text{C}$)

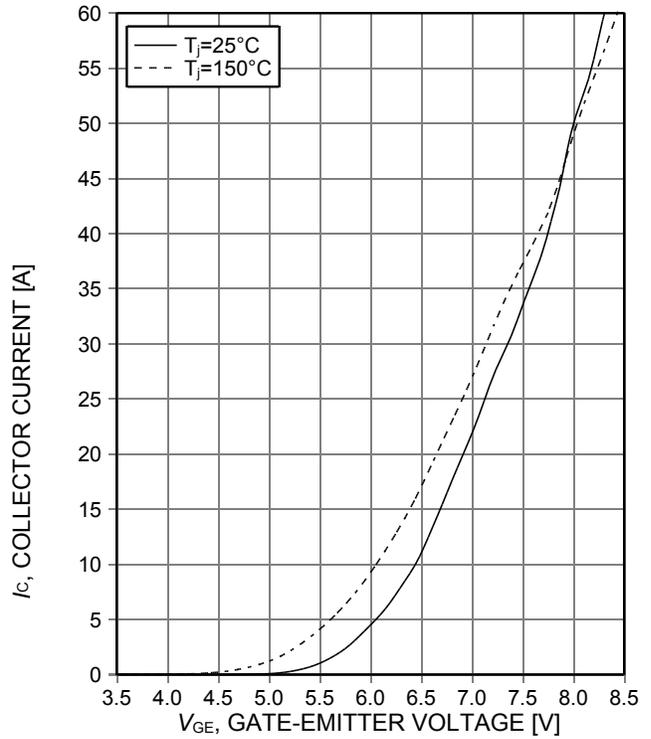


Figure 6. Typical transfer characteristic ($V_{CE}=20\text{V}$)

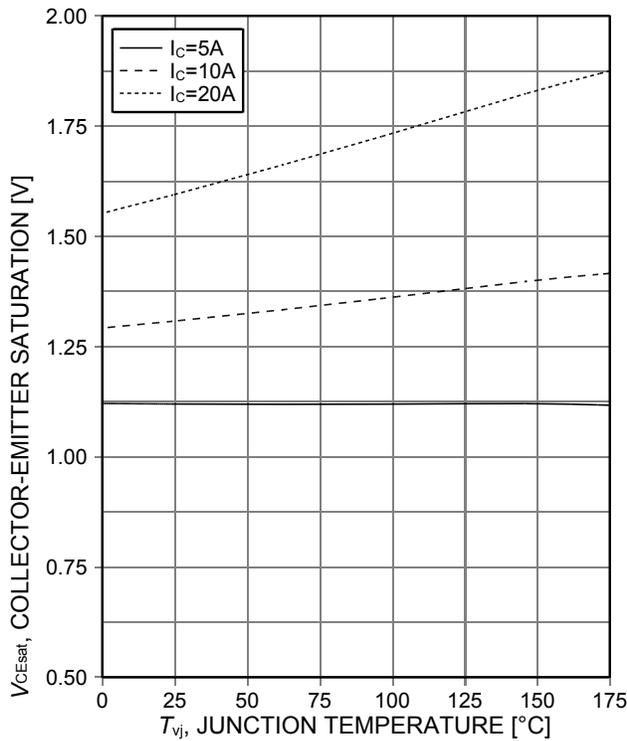


Figure 7. Typical collector-emitter saturation voltage as a function of junction temperature

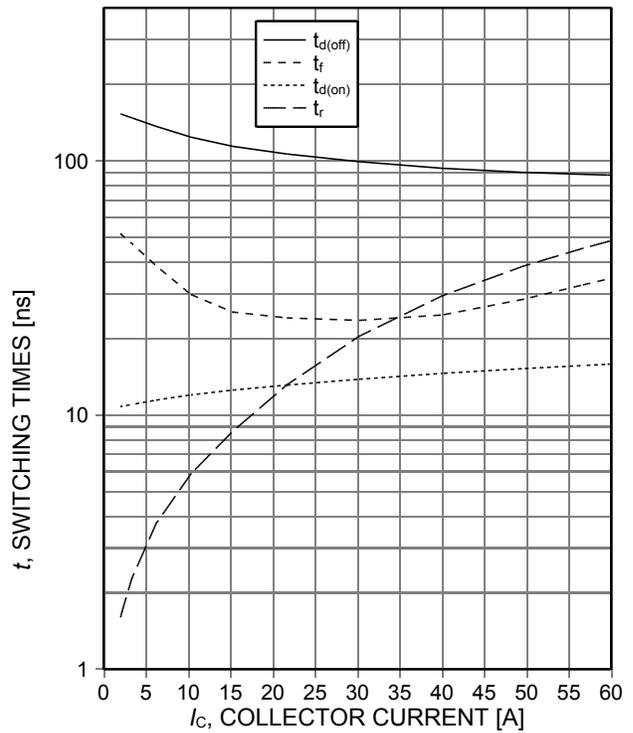


Figure 8. Typical switching times as a function of collector current

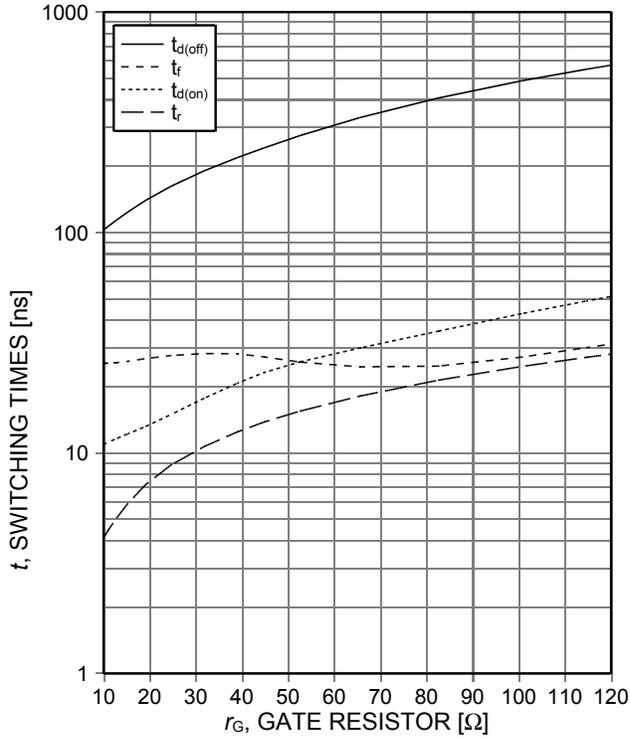


Figure 9. Typical switching times as a function of gate resistor

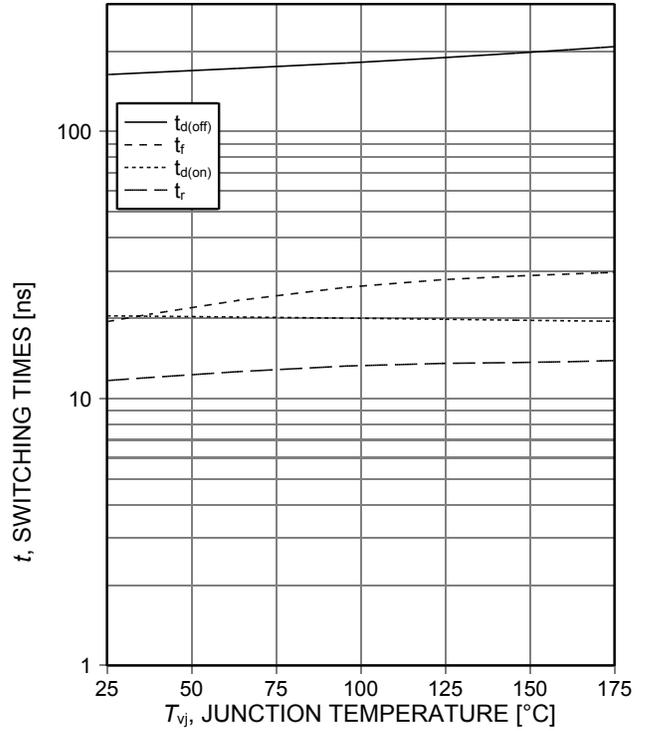


Figure 10. Typical switching times as a function of junction temperature

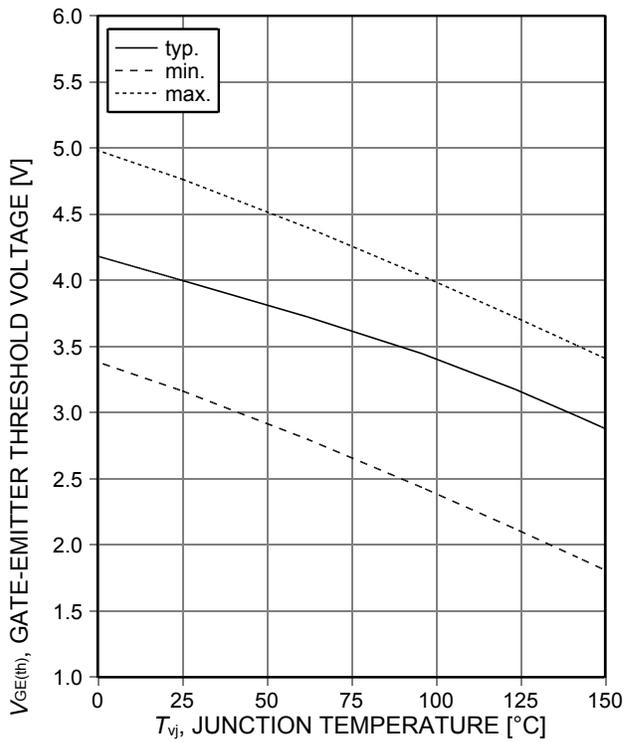


Figure 11. Gate-emitter threshold voltage as a function of junction temperature

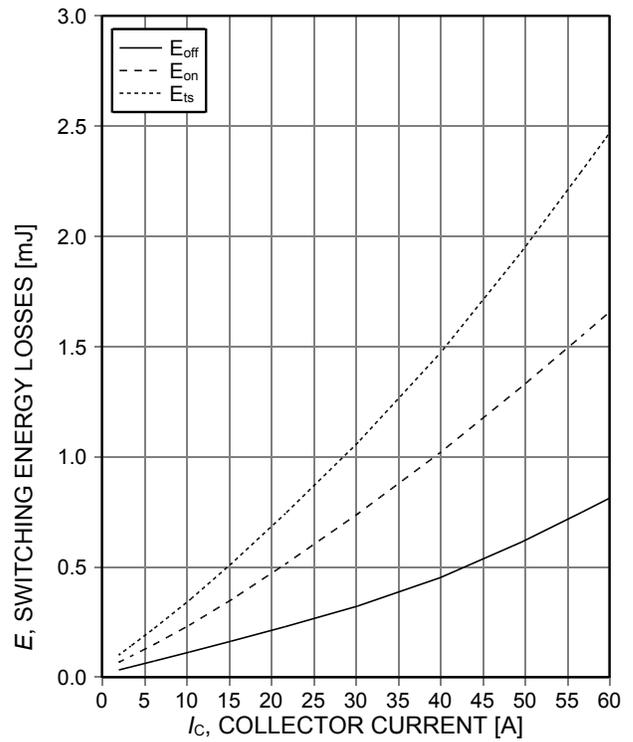


Figure 12. Typical switching energy losses as a function of collector current

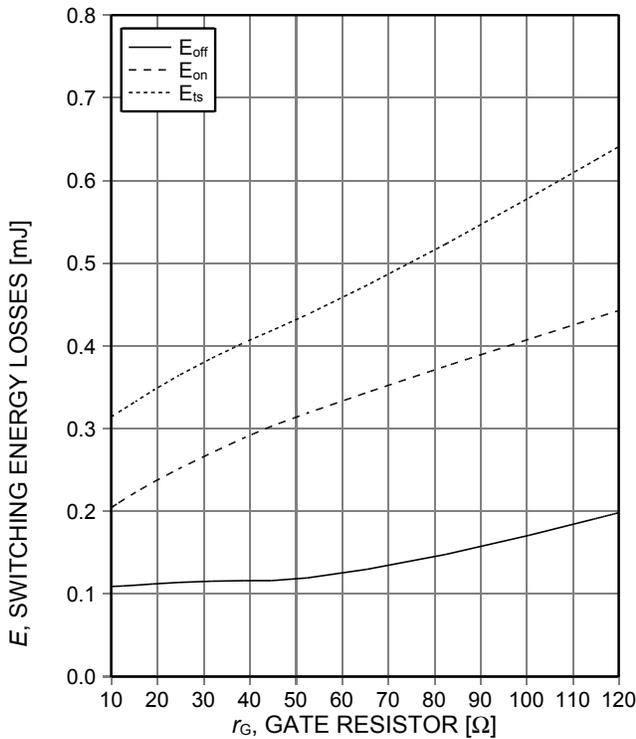


Figure 13. Typical switching energy losses as a function of gate resistor

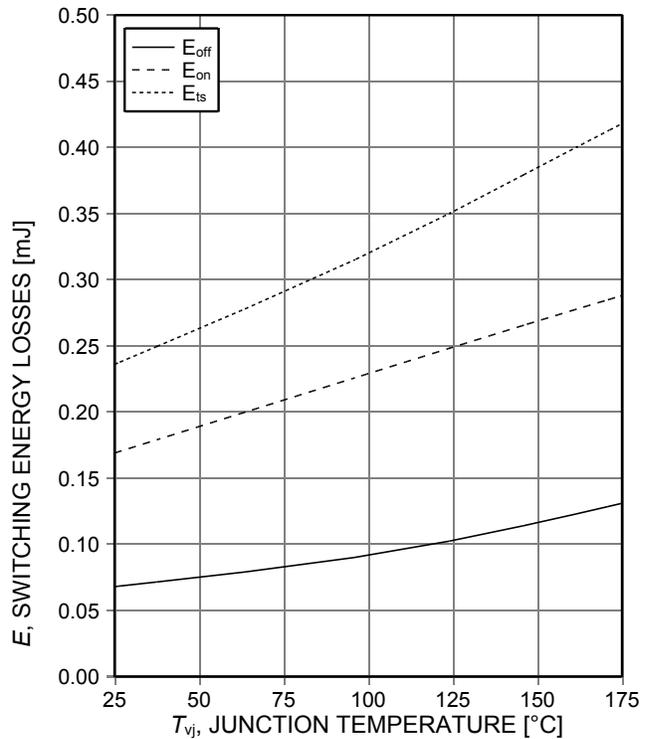


Figure 14. Typical switching energy losses as a function of junction temperature

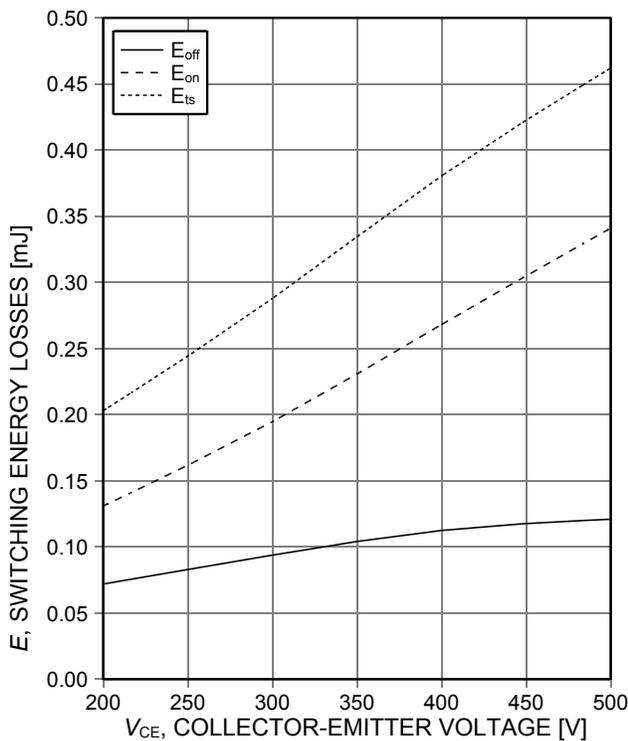


Figure 15. Typical switching energy losses as a function of collector emitter voltage

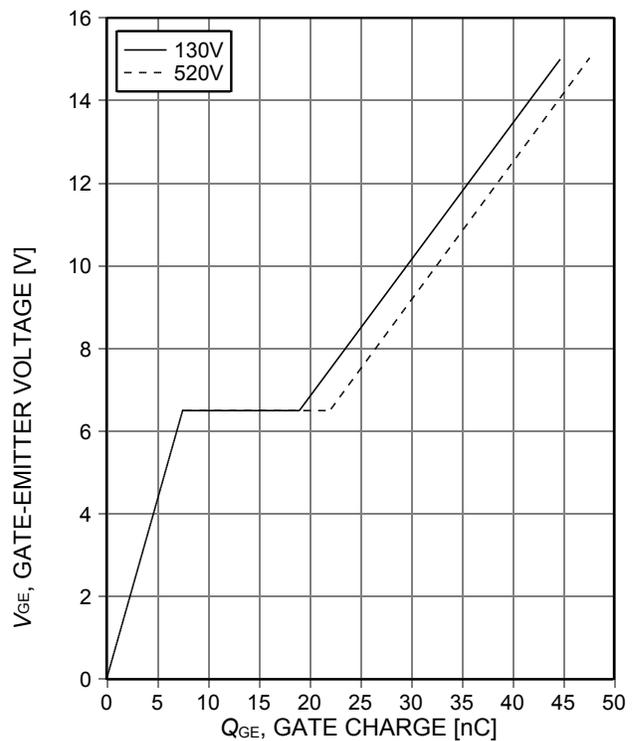


Figure 16. Typical gate charge

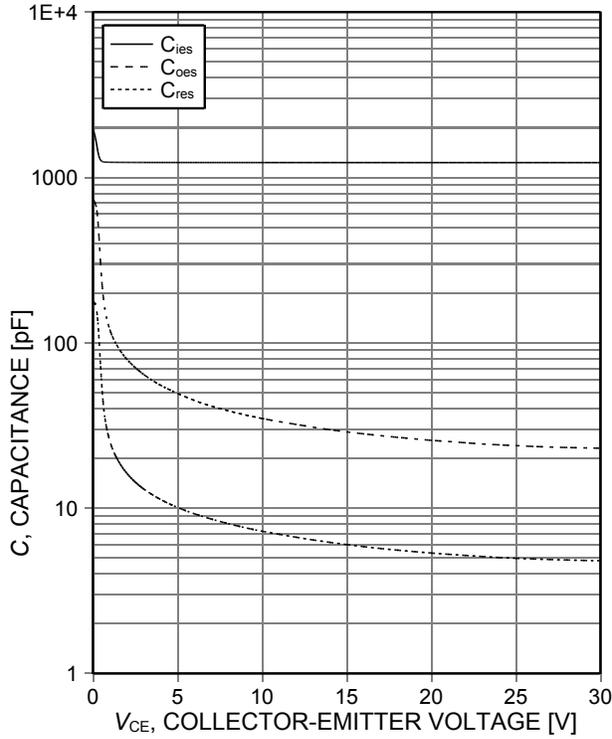


Figure 17. Typical capacitance as a function of collector-emitter voltage

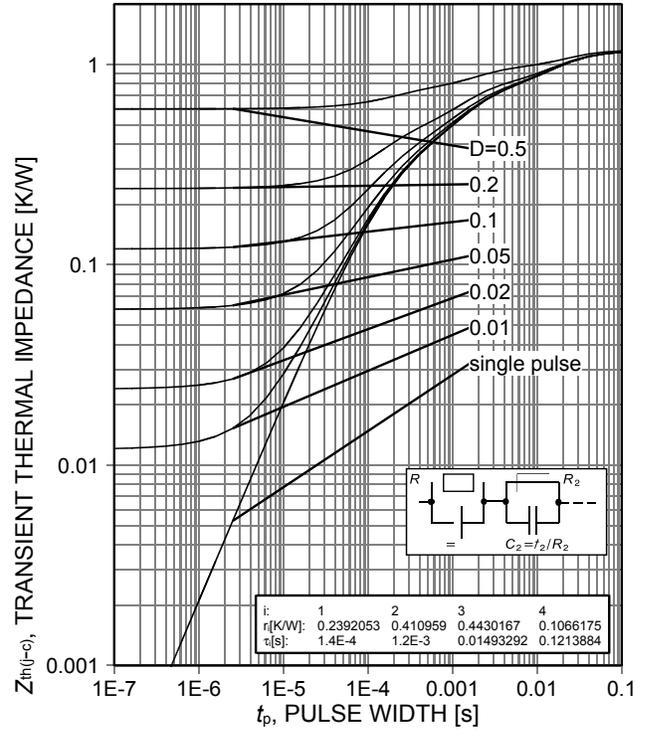


Figure 18. IGBT transient thermal impedance

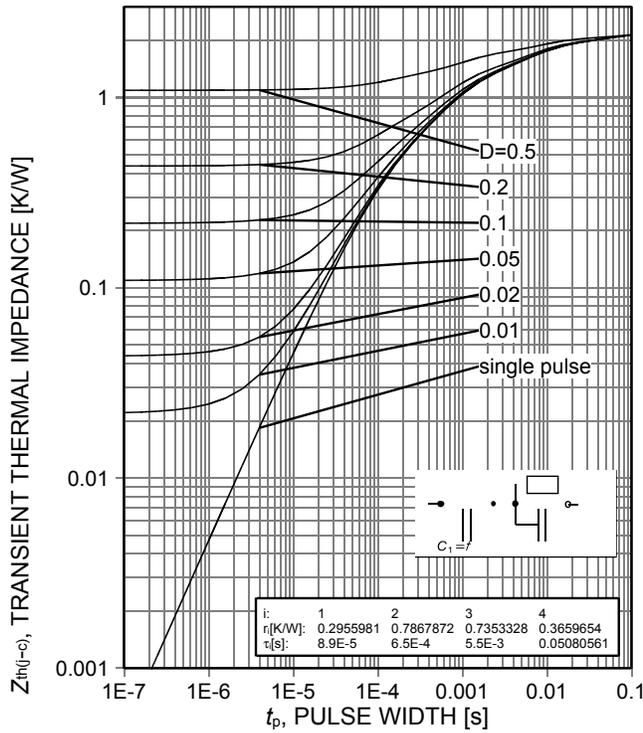


Figure 19. Diode transient thermal impedance as a function of pulse width

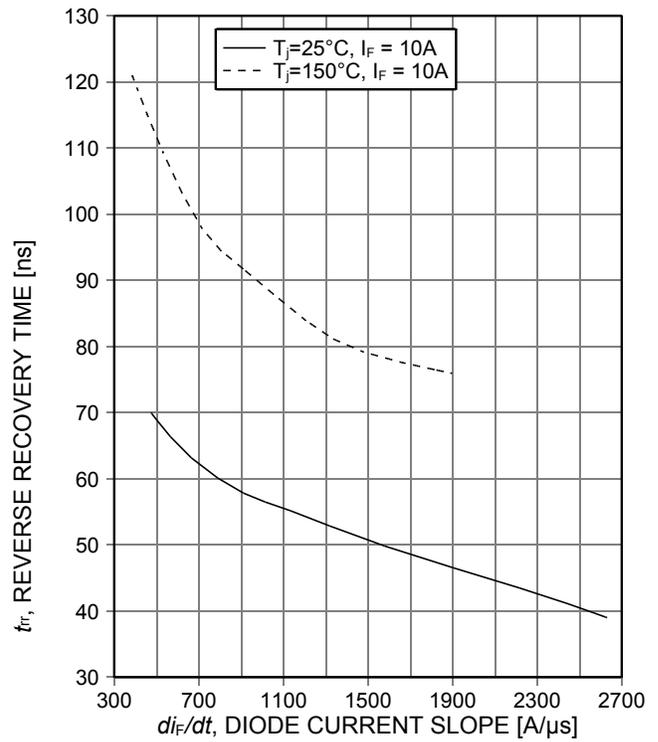
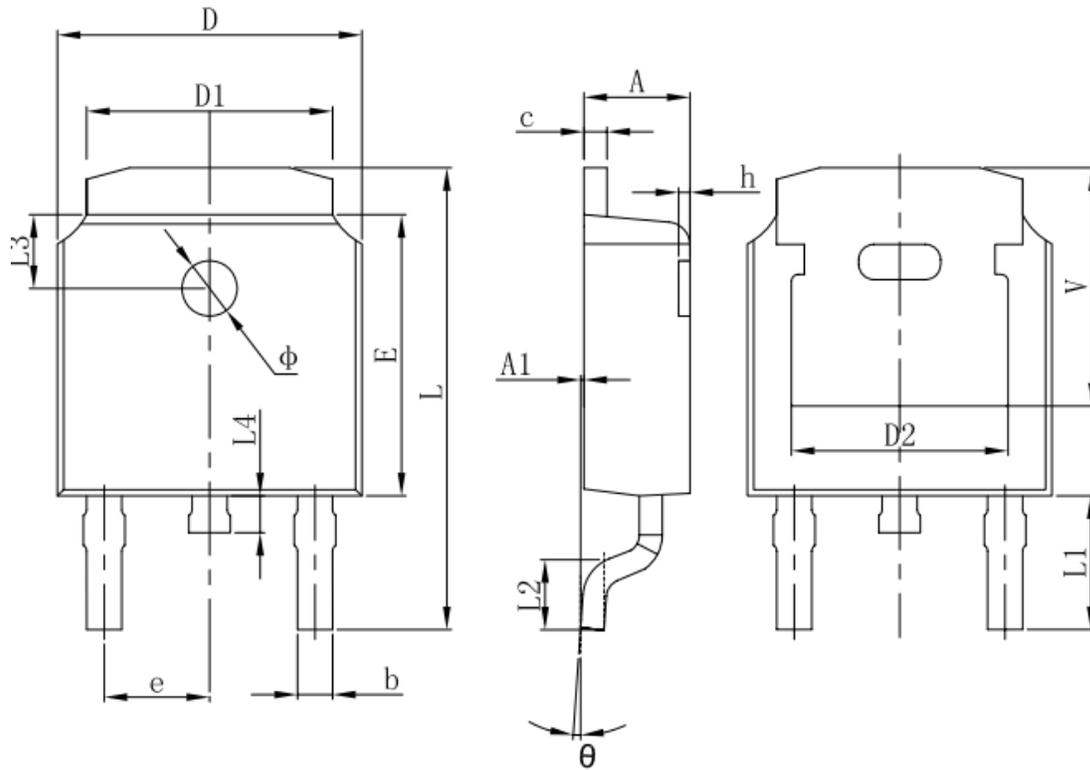


Figure 20. Typical reverse recovery time as a function of diode current slope

TO252 Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	2.200	2.400	0.087	0.094
A1	0.000	0.127	0.000	0.005
b	0.635	0.770	0.025	0.030
c	0.460	0.580	0.018	0.023
D	6.500	6.700	0.256	0.264
D1	5.100	5.460	0.201	0.215
D2	4.830 REF.		0.190 REF.	
E	6.000	6.200	0.236	0.244
e	2.186	2.386	0.086	0.094
L	9.712	10.312	0.382	0.406
L1	2.900 REF.		0.114 REF.	
L2	1.400	1.700	0.055	0.067
L3	1.600 REF.		0.063 REF.	
L4	0.600	1.000	0.024	0.039
Φ	1.100	1.300	0.043	0.051
θ	0°	8°	0°	8°
h	0.000	0.300	0.000	0.012
V	5.250 REF.		0.207 REF.	

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