

## 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)	1.7	
$I_{CM}$ (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)



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

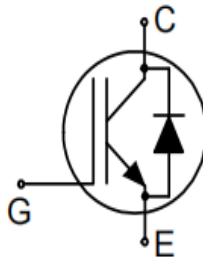
### APPLICATIONS

- 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-251



Top View

ABSOLUTE MAXIMUM RATINGS ( $T_C = 25\text{ °C}$ , unless otherwise noted)					
PARAMETER		SYMBOL	LIMIT	UNIT	
Collector-Emitter Voltage		$V_{CE}$	600	V	
Gate-Emitter Voltage		$V_{GE}$	$\pm 30$		
Continuous Collector Current ( $T_J = 150\text{ °C}$ )	$V_{GE}$ at 15 V	$I_C$	$T_C = 25\text{ °C}$	14	A
			$T_C = 100\text{ °C}$	7	
Pulsed Collector Current <sup>a</sup>		$I_{CM}$	21		
Diode Forward Current <sup>b</sup>		$I_F$	7	A	
Maximum Power Dissipation		$P_D$	$T_C = 25\text{ °C}$	33	W
			$T_C = 100\text{ °C}$	12.0	W
Operating Junction and Storage Temperature Range		$T_J, T_{stg}$	-55 to +175	°C	
Short Circuit Withstand Time $T_C=150$	$V_{GE}= 15V, V_{CE} = 400V$	tsc	3	$\mu s$	
Short Circuit Withstand Time $T_C=100$	$V_{GE}= 15V, V_{CE} = 330V$		5		
Soldering Recommendations (Peak Temperature) <sup>c</sup>			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	$R_{thJA}$	-	78	°C/W
Maximum Junction-to-Case	$R_{thJC}$	-	3.6	

SPECIFICATIONS ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
<b>Static</b>							
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	$I_{CES}$	$V_{CE} = 600\text{ V}, V_{GE} = 0\text{ V}, T_J = 25\text{ }^\circ\text{C}$		-	1	20	$\mu\text{A}$
		$V_{CE} = 600\text{ V}, V_{GE} = 0\text{ V}, T_J = 150\text{ }^\circ\text{C}$		-	1000	-	$\mu\text{A}$
Gate-Emitter Leakage Current	$I_{GES}$	$V_{CE} = 0\text{ V}, V_{GS} = \pm 2.0\text{ V}$		-	-	100	nA
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$V_{GE} = 7\text{ V}$	$I_C = 7\text{ A}$	-	1.7	2.1	V
Forward Transconductance	$g_{fs}$	$V_{CE} = 20\text{ V}, I_C = 7\text{ A}$		-	15	-	S
<b>Dynamic</b>							
Input Capacitance	$C_{ies}$	$V_{GE} = 0\text{ V}, V_{CE} = 25\text{ V},$ $f = 500\text{ KHz}$		-	1200	-	pF
Output Capacitance	$C_{oes}$			-	30	-	
Reverse Transfer Capacitance	$C_{res}$			-	28	-	
Turn-on Energy	$E_{on}$	$V_{CE} = 400\text{ V}, V_{GE} = 0/15\text{V},$ $I_C = 7\text{ A}, R_g = 10\Omega$		-	0.38	-	nJ
Turn-off Energy	$E_{off}$			-	0.18	-	
Total Gate Charge	$Q_g$	$V_{GE} = 7\text{ V}$	$I_C = 7\text{ A}, V_{CE} = 400\text{ V}$	-	5.8	-	nC
Gate-Emitter Charge	$Q_{ge}$			-	14	-	
Gate to Collector Charge	$Q_{gc}$			-	19	-	
Turn-On Delay Time	$t_{d(on)}$	$V_{CE} = 400\text{ V}, V_{GE} = 0/15\text{V},$ $I_C = 7\text{ A}, R_g = 10\Omega$		-	17	-	ns
Rise Time	$t_r$			-	29	-	
Turn-Off Delay Time	$t_{d(off)}$			-	108	-	
Fall Time	$t_f$			-	31	-	
Internal emitter inductance measured 5 mm	$L_E$			-	13	-	nH
<b>Diode Characteristics</b>							
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	$V_F$	$I_F = 7\text{ A}$		-	1.68	2.0	V
Reverse Recovery Time	$t_{rr}$	$T_J = 25\text{ }^\circ\text{C}, I_F = 7\text{ A},$ $dI_F/dt = 200\text{ A}/\mu\text{s}, V_R = 400\text{ V}$		-	60	-	ns
Reverse Recovery Charge	$Q_{rr}$			-	0.36	-	$\mu\text{C}$
Reverse Recovery Current	$I_{RRM}$			-	9	-	A

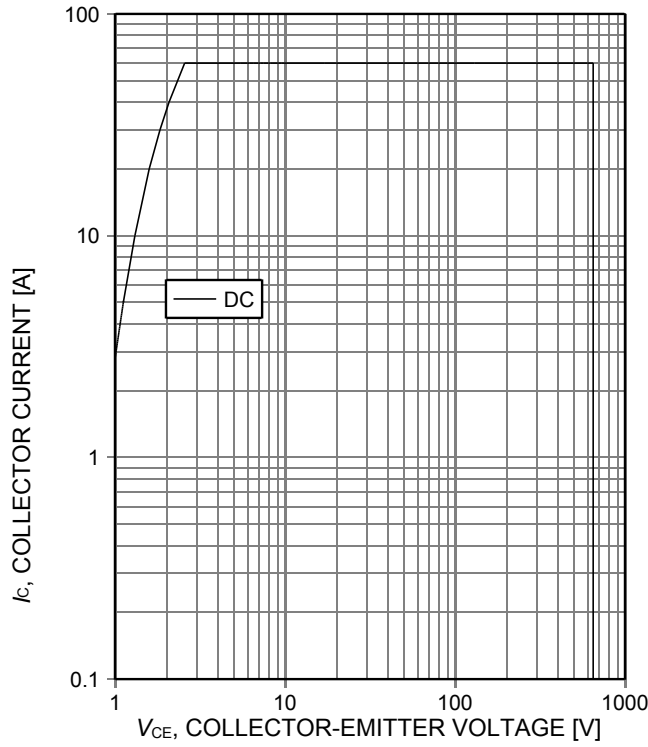


Figure 1. **Forward bias safe operating area**  
( $D=0$ ,  $T_C=25^\circ\text{C}$ ,  $T_{vj}\leq 175^\circ\text{C}$ ;  $V_{GE}=15\text{V}$ .  
Recommended use at  $V_{GE}\geq 7.5\text{V}$ )

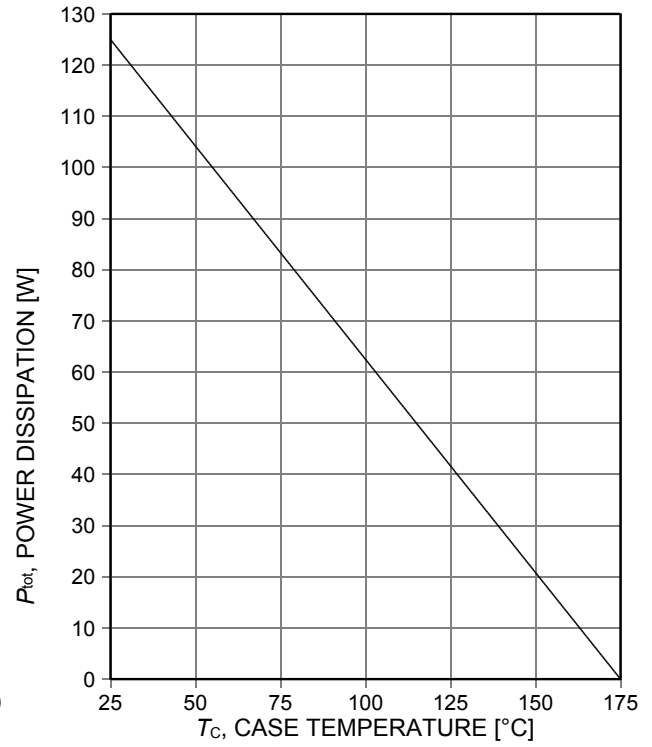


Figure 2. **Power dissipation as a function of case temperature**  
( $T_{vj}\leq 175^\circ\text{C}$ )

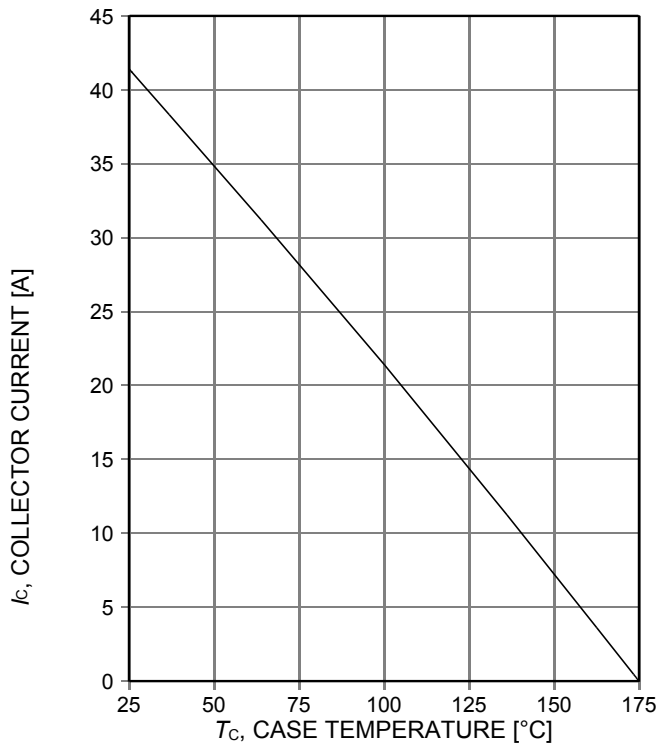


Figure 3. **Collector current as a function of case temperature**

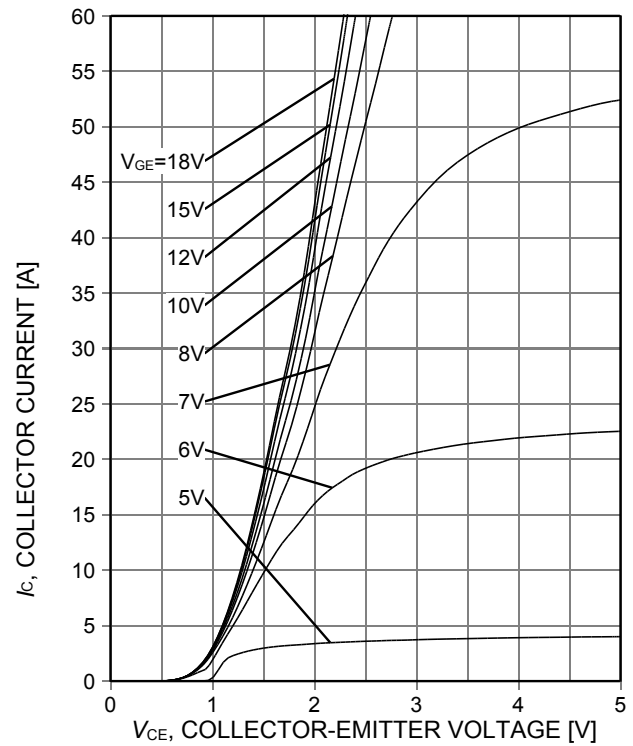


Figure 4. **Typical output characteristic**

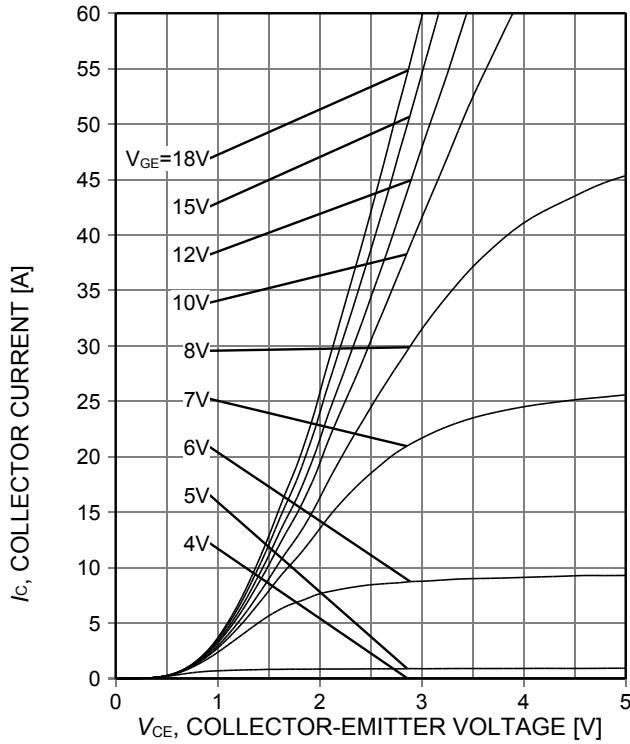


Figure 5. Typical output characteristic ( $T_{vj}=150^{\circ}\text{C}$ )

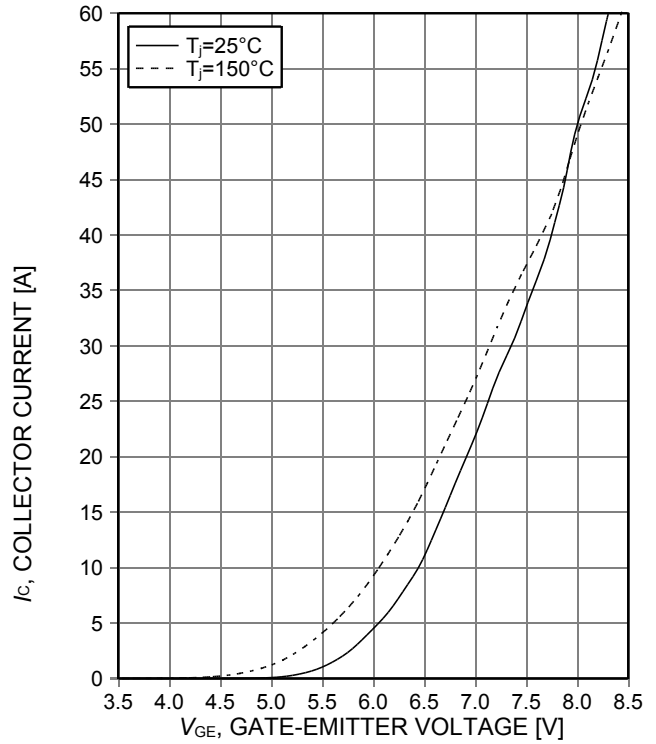


Figure 6. Typical transfer characteristic ( $V_{CE}=20\text{V}$ )

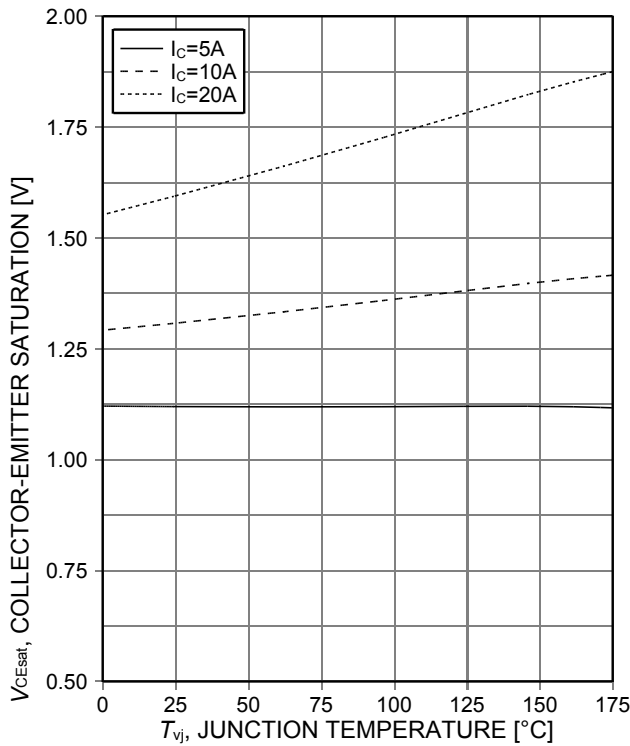


Figure 7. Typical collector-emitter saturation voltage as a function of junction temperature

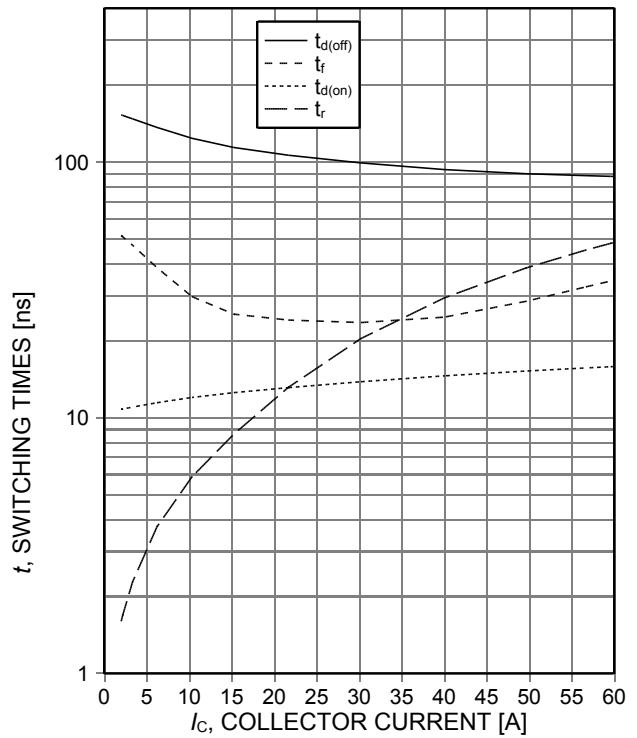


Figure 8. Typical switching times as a function of collector current

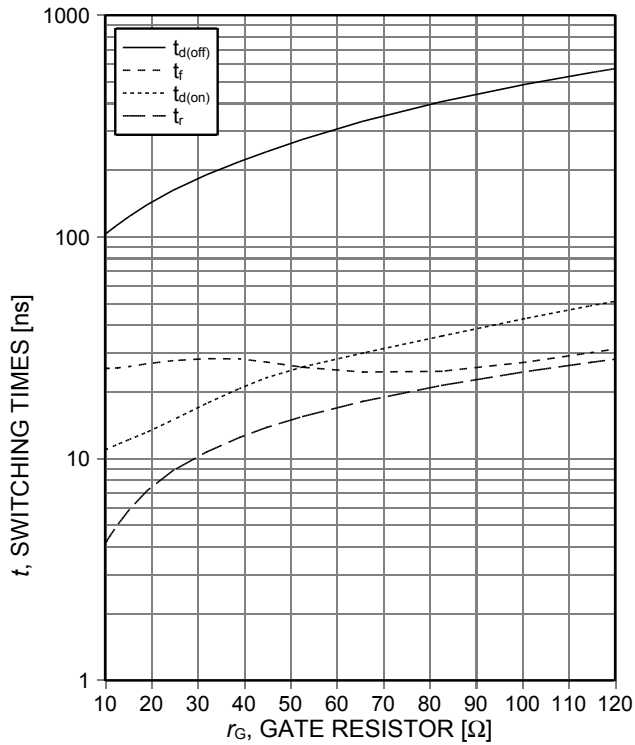


Figure 9. Typical switching times as a function of gate resistor

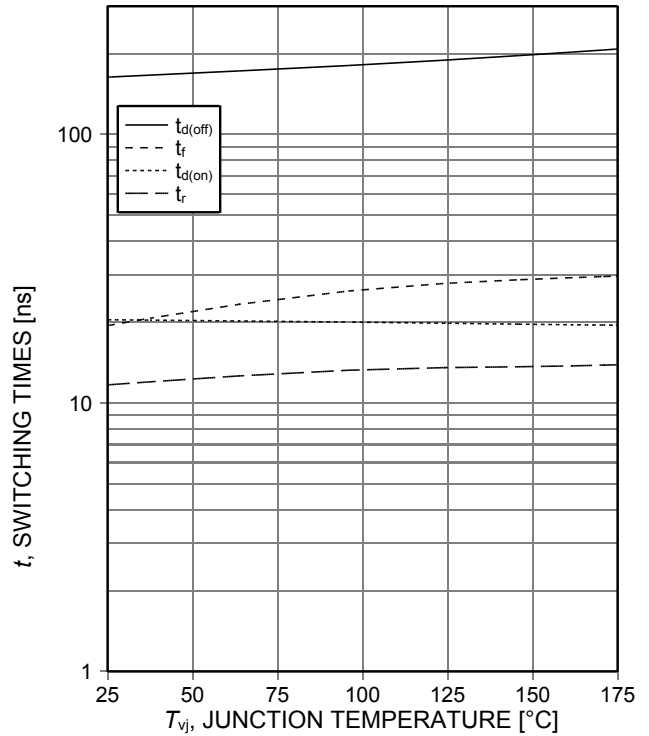


Figure 10. Typical switching times as a function of junction temperature

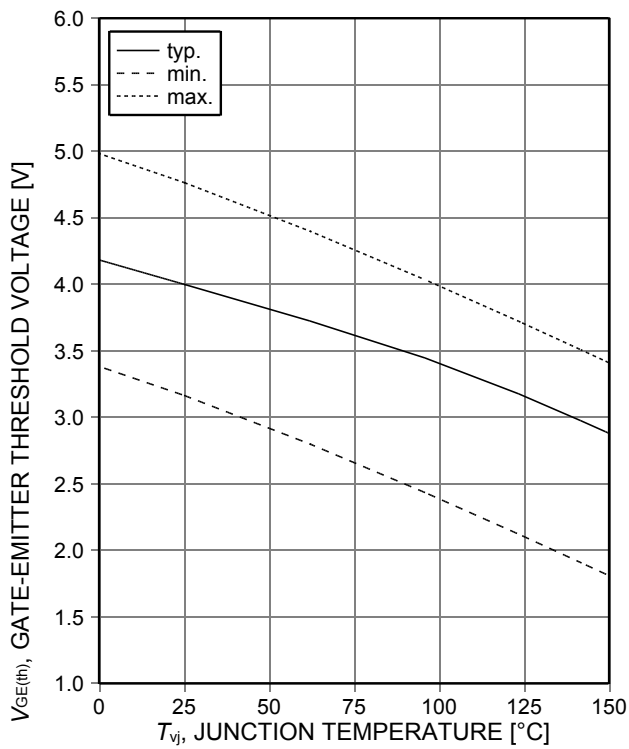


Figure 11. Gate-emitter threshold voltage as a function of junction temperature

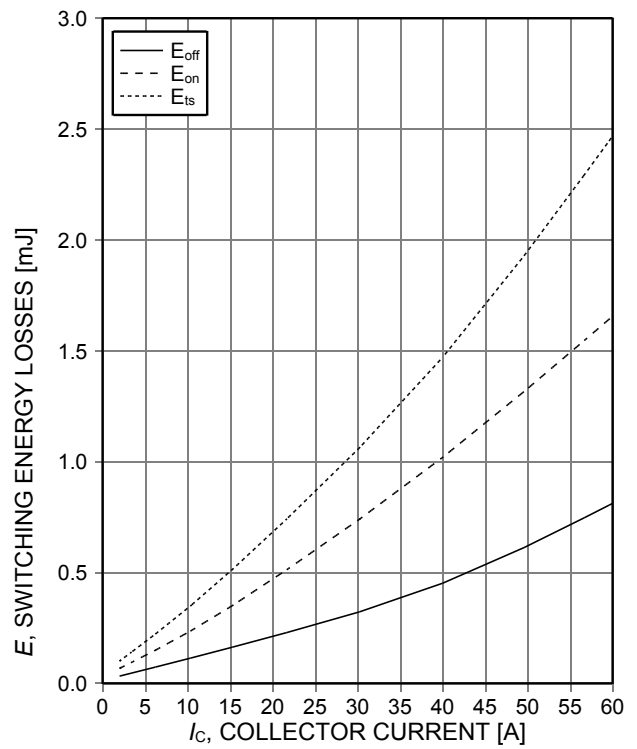


Figure 12. Typical switching energy losses as a function of collector current

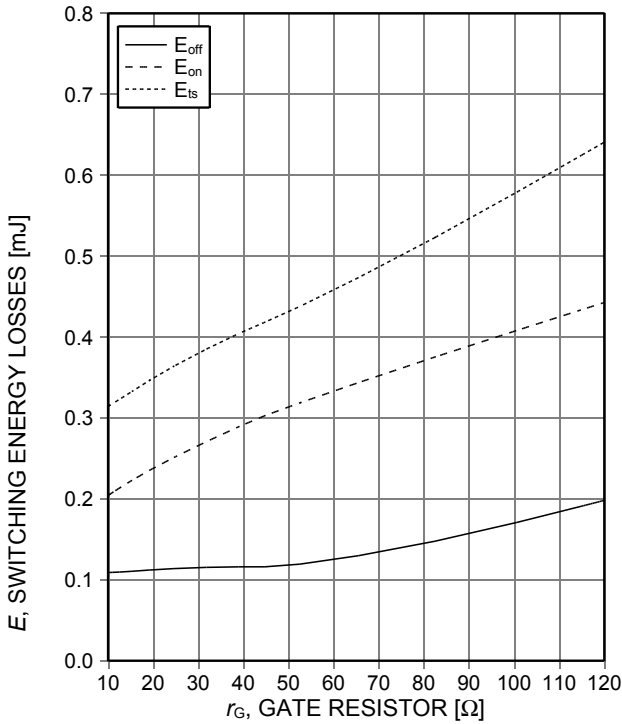


Figure 13. Typical switching energy losses as a function of gate resistor

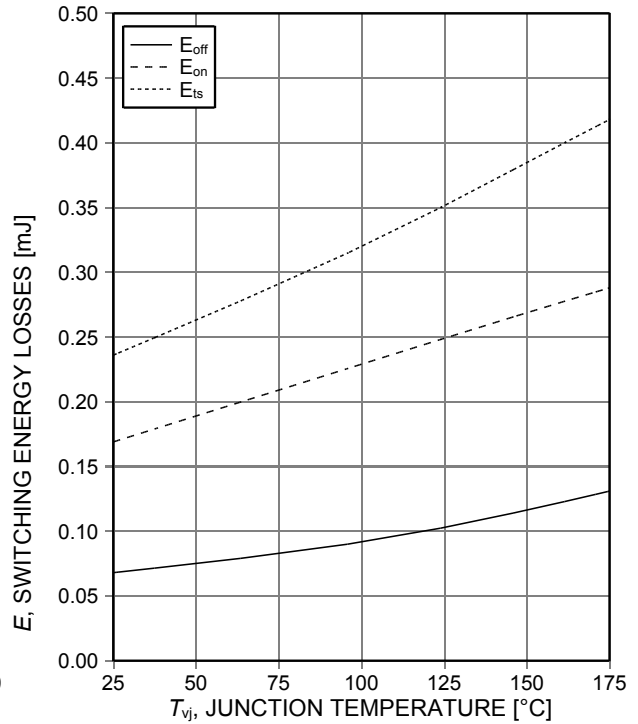


Figure 14. Typical switching energy losses as a function of junction temperature

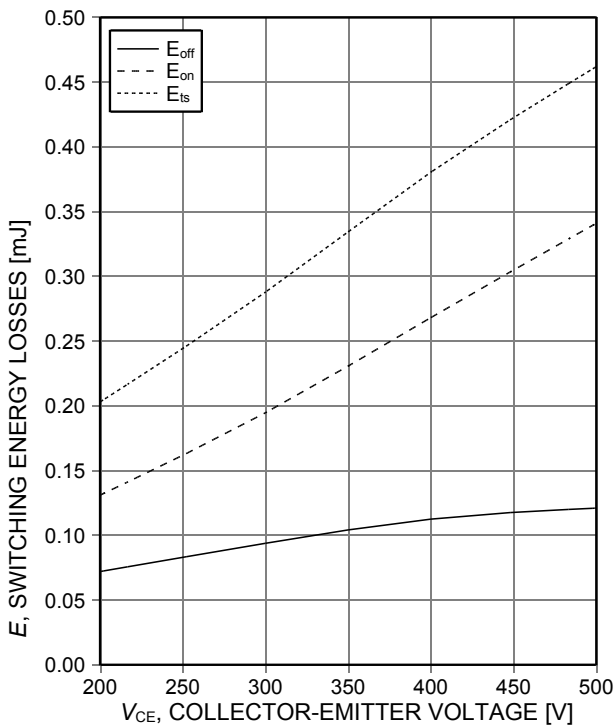


Figure 15. Typical switching energy losses as a function of collector emitter voltage

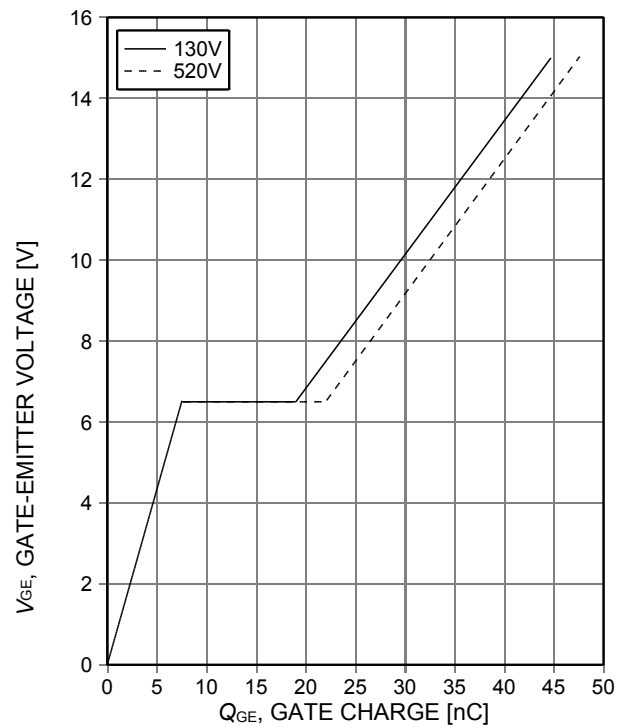


Figure 16. Typical gate charge

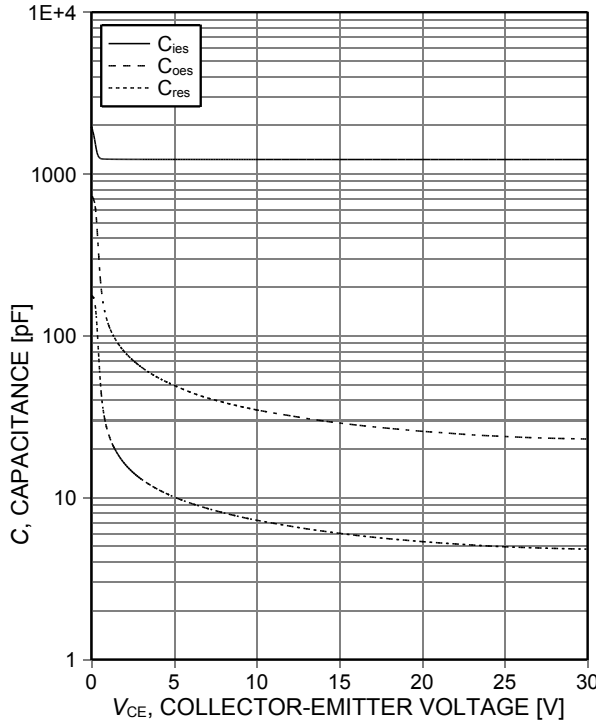


Figure 17. Typical capacitance as a function of collector-emitter voltage

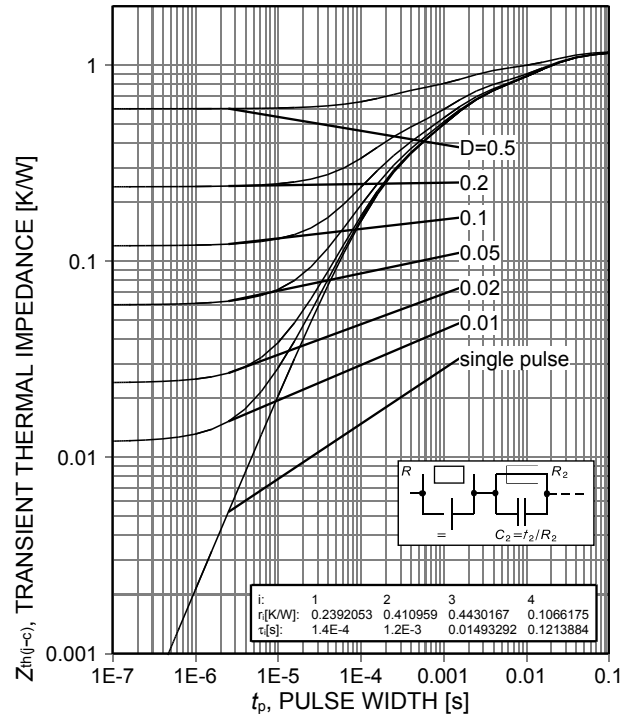


Figure 18. IGBT transient thermal impedance

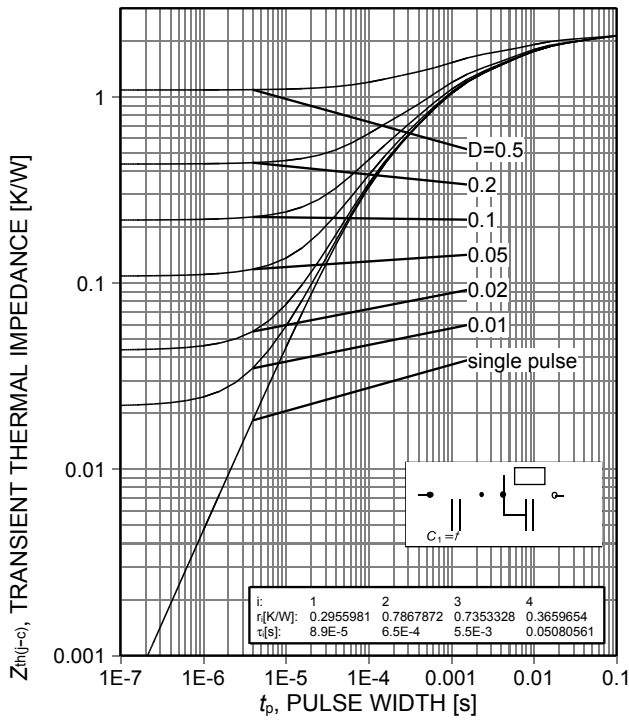


Figure 19. Diode transient thermal impedance as a function of pulse width

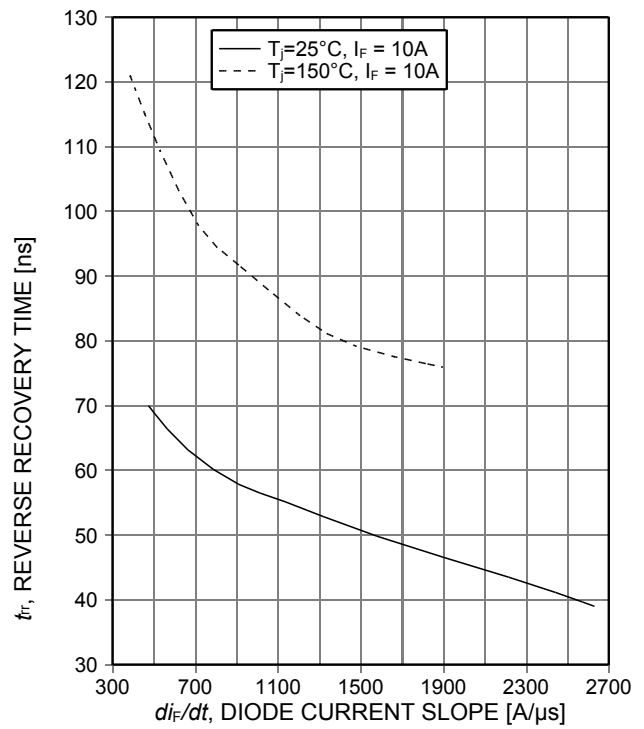
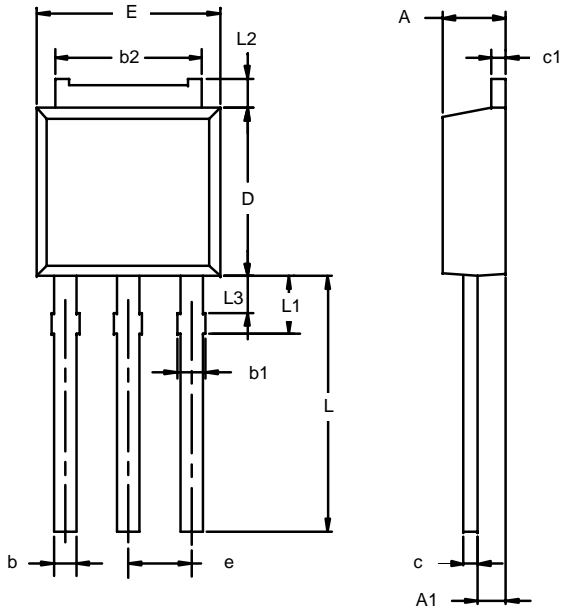


Figure 20. Typical reverse recovery time as a function of diode current slope

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Note: Dimension L3 is for reference only.

Dim	MILLIMETERS		INCHES	
	Min	Max	Min	Max
<b>A</b>	2.21	2.38	0.087	0.094
<b>A1</b>	0.89	1.14	0.035	0.045
<b>b</b>	0.71	0.89	0.028	0.035
<b>b1</b>	0.76	1.14	0.030	0.045
<b>b2</b>	5.23	5.43	0.206	0.214
<b>c</b>	0.46	0.58	0.018	0.023
<b>c1</b>	0.46	0.58	0.018	0.023
<b>D</b>	5.97	6.22	0.235	0.245
<b>E</b>	6.48	6.73	0.255	0.265
<b>e</b>	2.28 BSC		0.090 BSC	
<b>L</b>	8.89	9.53	0.350	0.375
<b>L1</b>	1.91	2.28	0.075	0.090
<b>L2</b>	0.89	1.27	0.035	0.050
<b>L3</b>	1.15	1.52	0.045	0.060



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