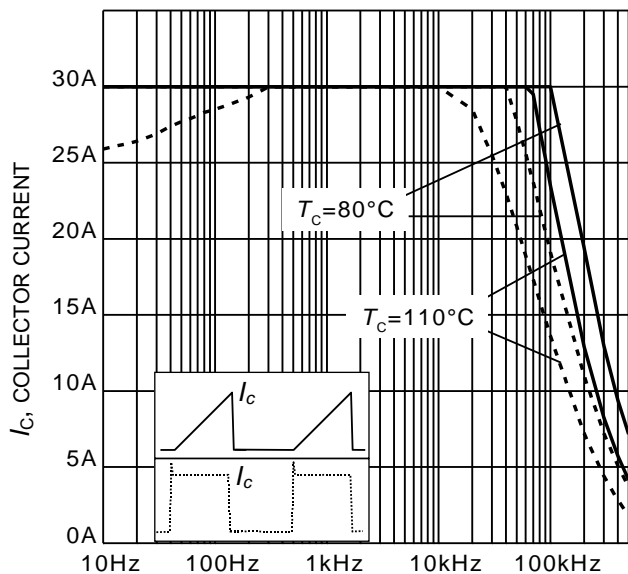


### Switching Characteristic, Inductive Load, at $T_j=25^\circ\text{C}$

Parameter	Symbol	Conditions	Value			Unit	
			min.	typ.	max.		
<b>IGBT Characteristic</b>							
Turn-on delay time	$t_{d(on)}$	$T_j=25^\circ\text{C}$ , $V_{CC}=400\text{V}$ , $I_C=10\text{A}$ , $V_{GE}=0/15\text{V}$ , $r_G=23\Omega$ , $L_\sigma=60\text{nH}$ , $C_\sigma=40\text{pF}$	-	12	-	ns	
Rise time	$t_r$		-	8	-		
Turn-off delay time	$t_{d(off)}$		-	215	-		
Fall time	$t_f$		-	38	-		
Turn-on energy	$E_{on}$	$L_\sigma$ , $C_\sigma$ from Fig. E Energy losses include "tail" and diode reverse recovery.	-	0.16	-	mJ	
Turn-off energy	$E_{off}$		-	0.27	-		
Total switching energy	$E_{ts}$		-	0.43	-		
<b>Anti-Parallel Diode Characteristic</b>							
Diode reverse recovery time	$t_{rr}$	$T_j=25^\circ\text{C}$ , $V_R=400\text{V}$ , $I_F=10\text{A}$ , $di_F/dt=880\text{A}/\mu\text{s}$	-	115	-	ns	
Diode reverse recovery charge	$Q_{rr}$		-	0.38	-		$\mu\text{C}$
Diode peak reverse recovery current	$I_{rrm}$		-	10	-		
Diode peak rate of fall of reverse recovery current during $t_b$	$di_{rr}/dt$		-	680	-		$\text{A}/\mu\text{s}$

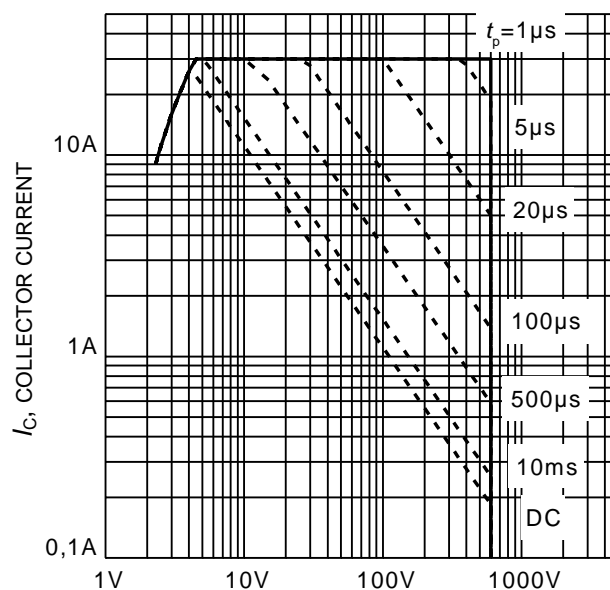
### Switching Characteristic, Inductive Load, at $T_j=175^\circ\text{C}$

Parameter	Symbol	Conditions	Value			Unit	
			min.	typ.	max.		
<b>IGBT Characteristic</b>							
Turn-on delay time	$t_{d(on)}$	$T_j=175^\circ\text{C}$ , $V_{CC}=400\text{V}$ , $I_C=10\text{A}$ , $V_{GE}=0/15\text{V}$ , $r_G=23\Omega$ , $L_\sigma=60\text{nH}$ , $C_\sigma=40\text{pF}$	-	10	-	ns	
Rise time	$t_r$		-	11	-		
Turn-off delay time	$t_{d(off)}$		-	233	-		
Fall time	$t_f$		-	63	-		
Turn-on energy	$E_{on}$	$L_\sigma$ , $C_\sigma$ from Fig. E Energy losses include "tail" and diode reverse recovery.	-	0.26	-	mJ	
Turn-off energy	$E_{off}$		-	0.35	-		
Total switching energy	$E_{ts}$		-	0.61	-		
<b>Anti-Parallel Diode Characteristic</b>							
Diode reverse recovery time	$t_{rr}$	$T_j=175^\circ\text{C}$ , $V_R=400\text{V}$ , $I_F=10\text{A}$ , $di_F/dt=880\text{A}/\mu\text{s}$	-	200	-	ns	
Diode reverse recovery charge	$Q_{rr}$		-	0.92	-		$\mu\text{C}$
Diode peak reverse recovery current	$I_{rrm}$		-	13	-		
Diode peak rate of fall of reverse recovery current during $t_b$	$di_{rr}/dt$		-	390	-		$\text{A}/\mu\text{s}$



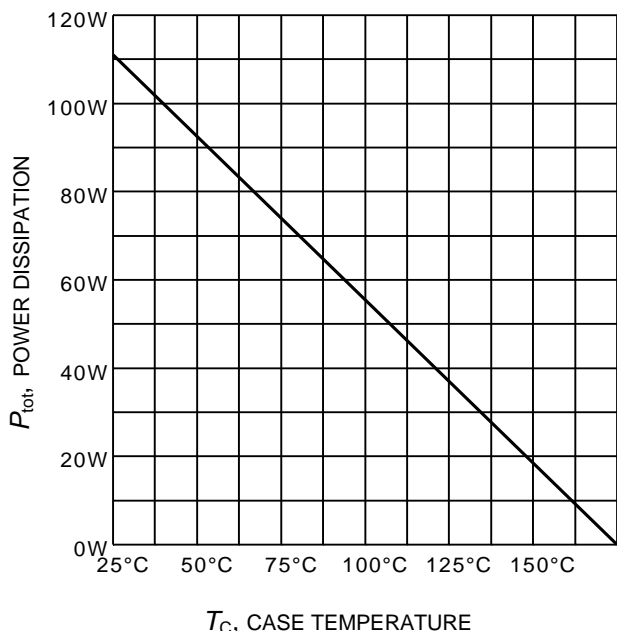
$f$ , SWITCHING FREQUENCY

**Figure 1. Collector current as a function of switching frequency**  
 ( $T_j \leq 175^\circ\text{C}$ ,  $D = 0.5$ ,  $V_{CE} = 400\text{V}$ ,  
 $V_{GE} = 0/15\text{V}$ ,  $r_G = 23\Omega$ )



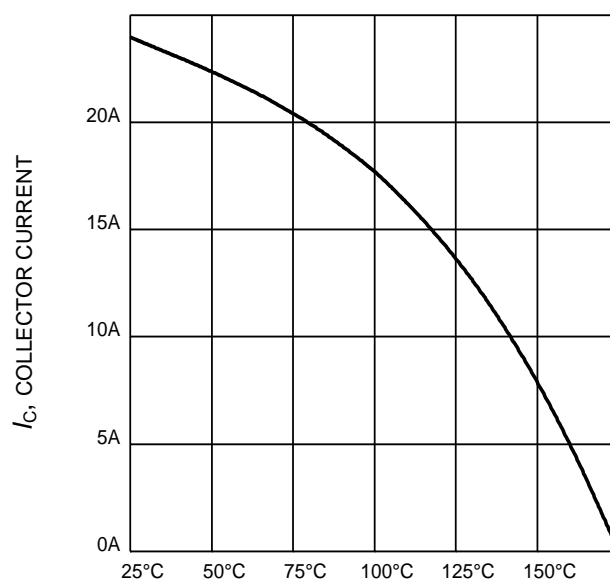
$V_{CE}$ , COLLECTOR-EMITTER VOLTAGE

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



$T_C$ , 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**  
 ( $V_{GE} \geq 15\text{V}$ ,  $T_j \leq 175^\circ\text{C}$ )