

Features

- Extremely Low Switching Loss
- Very low collector-emitter saturation voltage V_{CEsat}
- Very soft, fast recovery antiparallel diode
- Smooth switching behavior
- Optimized for hard switching, two- and three-level topologies

Application

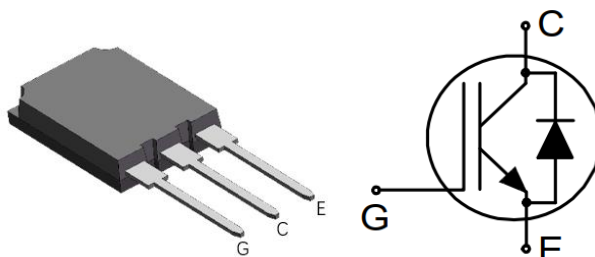
- Industrial UPS
- EV-Charging
- String inverter
- Welding

Product Summary

V_{CE}	1200V
I_C	140A
$V_{CE(SAT)}$	1.7V

100% DVDS Tested

100% Double Pulse Tested



Package Marking and Ordering Information

Part #	Marking	Package	Packing	Reel Size	Tape Width	Qty
SKQ140N120CH7DI	140N120CH7DI	TO-247Plus-3L	Tube	N/A	N/A	30pcs

Absolute Maximum Ratings

Parameter		Symbol	Value	Unit
Collector-to-Emitter Voltage		V_{CES}	1200	V
Gate-to-Emitter Voltage		V_{GES}	± 20	V
Transient Gate-to-Emitter Voltage		V_{GES}	± 30	V
Collector Current (limited by bondwire)	$T_C = 25^\circ\text{C}$	I_C	175	A
	$T_C = 100^\circ\text{C}$		154	
Pulsed Collector Current		I_{CM}	560	A
Diode Forward Current (limited by bondwire)	$T_C = 25^\circ\text{C}$	I_F	170	A
	$T_C = 91^\circ\text{C}$		140	
Pulsed Diode Forward Current		I_{FM}	560	A
IGBT Power Dissipation	$T_C = 25^\circ\text{C}$	P_{tot}	962	W
	$T_C = 100^\circ\text{C}$		481	
FRD Power Dissipation	$T_C = 25^\circ\text{C}$	P_{tot}	549	W
	$T_C = 100^\circ\text{C}$		275	
Operating Junction Temperature		T_{Vj}	$-40 \sim +175$	$^\circ\text{C}$
Storage Temperature		T_{STG}	$-55 \sim +150$	$^\circ\text{C}$

Thermal Resistance

Parameter	Symbol	Min	Typ	Max	Unit
Thermal Resistance, Junction-Case for IGBT	R_{thJC}		0.12	0.16	°C/W
Thermal Resistance, Junction-Case for Diode			0.21	0.27	
Thermal Resistance, Junction-Ambient	R_{thJA}			40	

Electrical Characteristics ($T_J = 25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Test Condition		Min	Typ	Max	Unit
Static Characteristics							
Collector–Emitter Breakdown Voltage	BV_{CE}	$V_{GE}=0V, I_C=1mA$		1200			V
Collector–Emitter Cut–Off Current	I_{CES}	$V_{CE}=1200V, V_{GE}=0V$	$T_{vj}=25^{\circ}C$			40	μA
			$T_{vj}=175^{\circ}C$		17500		
Gate–Emitter Leakage Current	I_{GES}	$V_{GE}=20V, V_{CE}=0V$				100	nA
Gate–Emitter Threshold Voltage	$V_{GE(th)}$	$I_C=2.24mA, V_{CE}=V_{GE}$		4.7	5.5	6.2	V
Collector–Emitter Saturation Voltage	$V_{CE(SAT)}$	$I_C=140A, V_{GE}=15V$	$T_{vj}=25^{\circ}C$		1.7	2.15	V
			$T_{vj}=175^{\circ}C$		2		
Dynamic Characteristics							
Input Capacitance	C_{ies}	$V_{CE} = 25V, V_{GE} = 0V, f = 100kHz$			18500		pF
Output Capacitance	C_{oes}				317		
Reverse Transfer Capacitance	C_{res}				94		
Switching Characteristics							
Total Gate Charge	Q_g	$V_{CE} = 960V, V_{GE} = 15V, I_C = 140A$			970		nC
Turn-on Delay Time	$t_{d(on)}$	$V_{CC} = 600V, V_{GE} = 0/15V, I_C=140A, R_{G(on)}= 4.8\Omega, R_{G(off)}= 4.8\Omega$	$T_{vj}=25^{\circ}C$		68		ns
			$T_{vj}=175^{\circ}C$		63		
Turn-on Rise Time	t_r		$T_{vj}=25^{\circ}C$		55		
			$T_{vj}=175^{\circ}C$		46		
Turn-off Delay Ttime	$t_{d(off)}$		$T_{vj}=25^{\circ}C$		541		
			$T_{vj}=175^{\circ}C$		619		
Turn-off Fall Time	t_f		$T_{vj}=25^{\circ}C$		21		
			$T_{vj}=175^{\circ}C$		92		
Turn–on Switching Loss	E_{on}		$T_{vj}=25^{\circ}C$		8.84		mJ
			$T_{vj}=175^{\circ}C$		11.8		
Turn–off Switching Loss	E_{off}		$T_{vj}=25^{\circ}C$		6.38		
			$T_{vj}=175^{\circ}C$		6.71		
Total Switching Loss	E_{ts}		$T_{vj}=25^{\circ}C$		12.2		
			$T_{vj}=175^{\circ}C$		18.5		

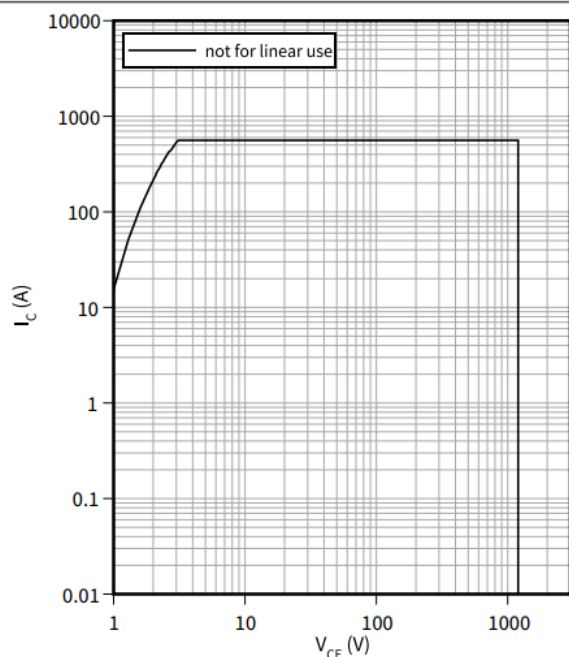
FRD Characteristic

Parameter	Symbol	Test Condition		Min	Typ	Max	Unit	
Forward Voltage	V _F	I _F = 140A	T _{vj} =25℃		2.5	3	V	
			T _{vj} =175℃		2.3			
Reverse Recovery Time	t _{rr}	V _R =600V,I _F =140 A, R _{G(on)} =4.8 Ω	T _{vj} =25℃		144		ns	
			T _{vj} =175℃		227			
Body Diode Reverse Recovery Charge	Q _{rr}		T _{vj} =25℃		3.82		μC	
			T _{vj} =175℃		11.5			
Peak Reverse Recovery Current	I _{rrm}		T _{vj} =25℃		53		A	
			T _{vj} =175℃		101			
Diode peak rate of fall of reverse recovery current	di _{rr} /dt		T _{vj} =25℃		-529		A/μs	
			T _{vj} =175℃		-646			
Reverse Recovery Energy	E _{rec}		T _{vj} =25℃		1.12		mJ	
			T _{vj} =175℃		3.81			

Typical Performance Characteristics
Reverse bias safe operating area

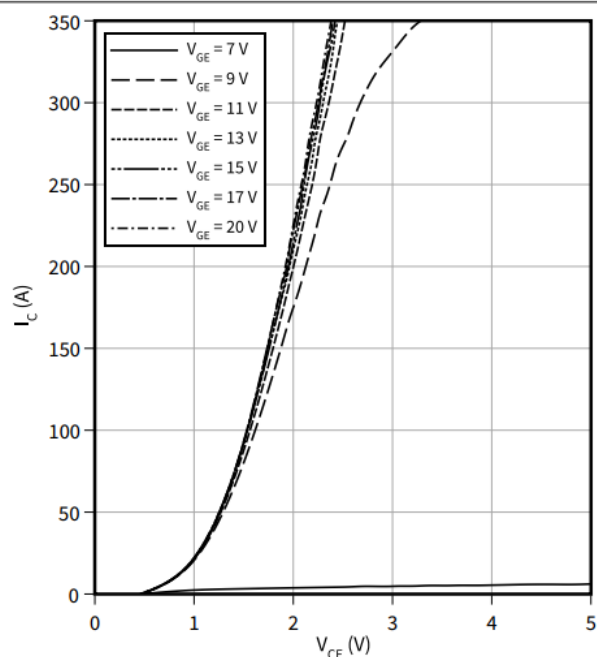
$$I_C = f(V_{CE})$$

$$T_{vj} \leq 175^\circ\text{C}, V_{GE} = 0/15\text{ V}$$


Typical output characteristic

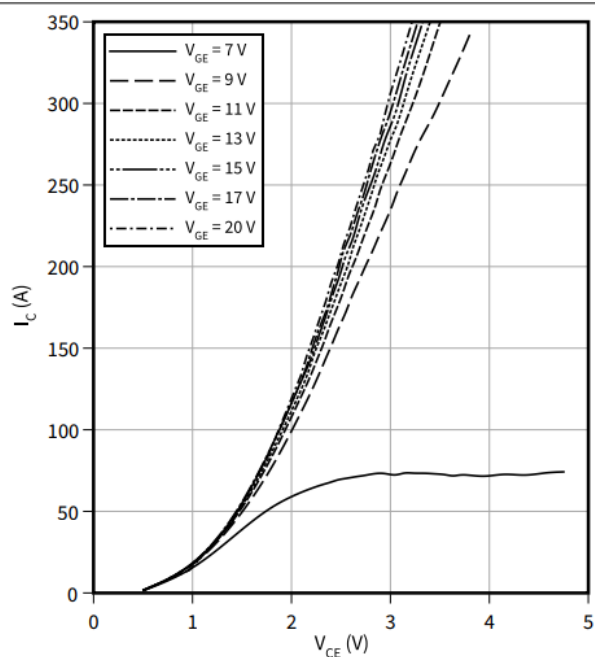
$$I_C = f(V_{CE})$$

$$T_{vj} = 25^\circ\text{C}$$


Typical output characteristic

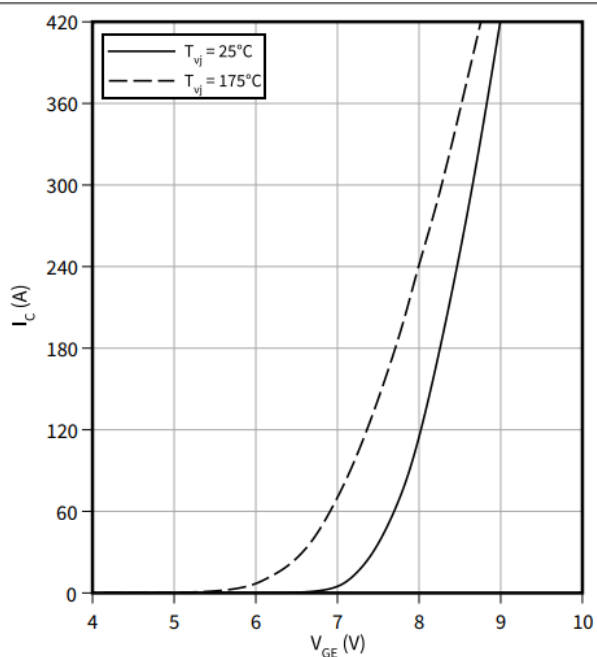
$$I_C = f(V_{CE})$$

$$T_{vj} = 175^\circ\text{C}$$


Typical transfer characteristic

$$I_C = f(V_{GE})$$

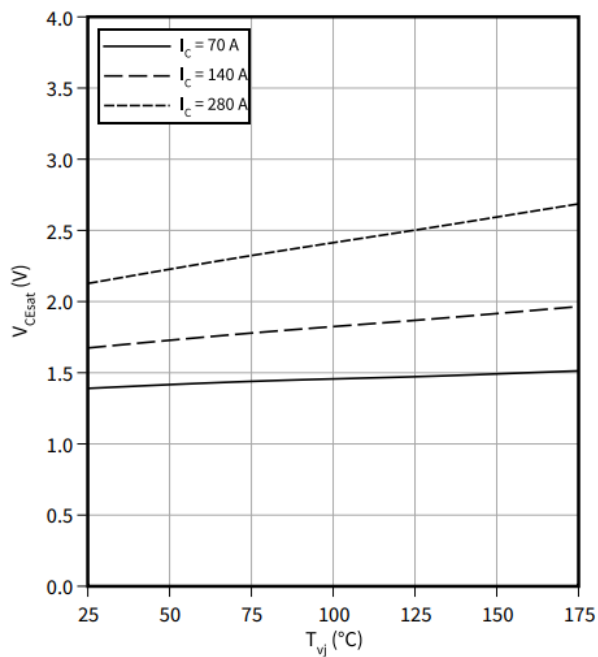
$$V_{CE} = 20\text{ V}$$



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

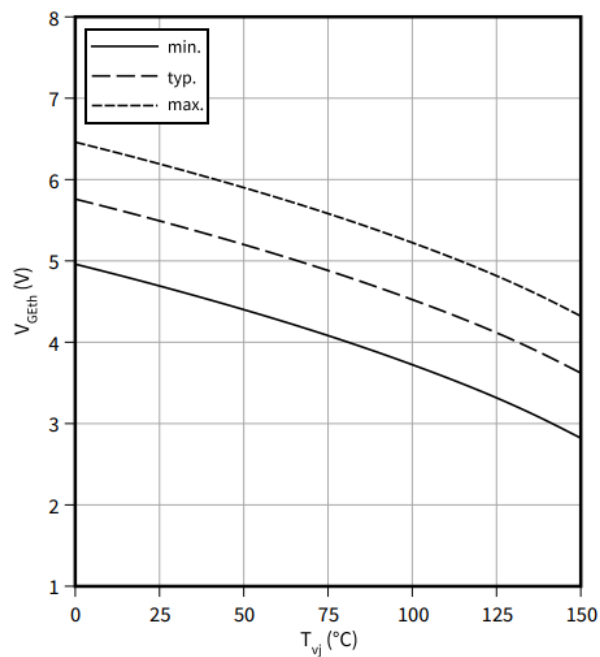
$$V_{CEsat} = f(T_{vj})$$

$$V_{GE} = 15 \text{ V}$$


Gate-emitter threshold voltage as a function of junction temperature

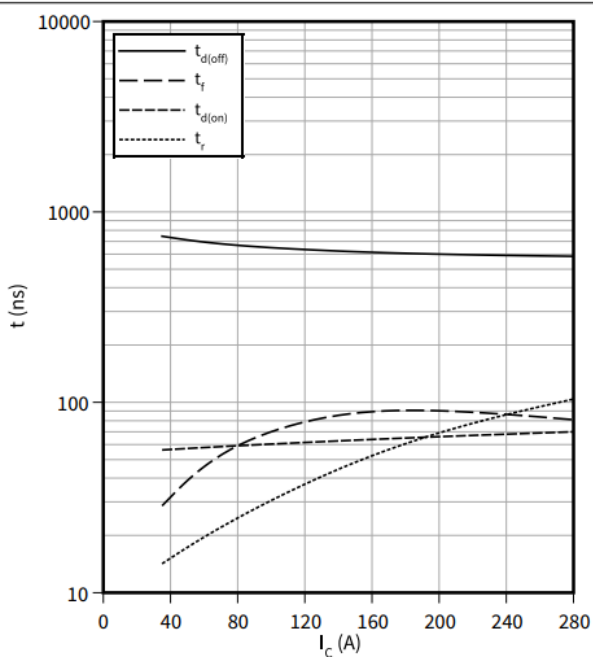
$$V_{GETh} = f(T_{vj})$$

$$I_c = 2.24 \text{ mA}$$


Typical switching times as a function of collector current

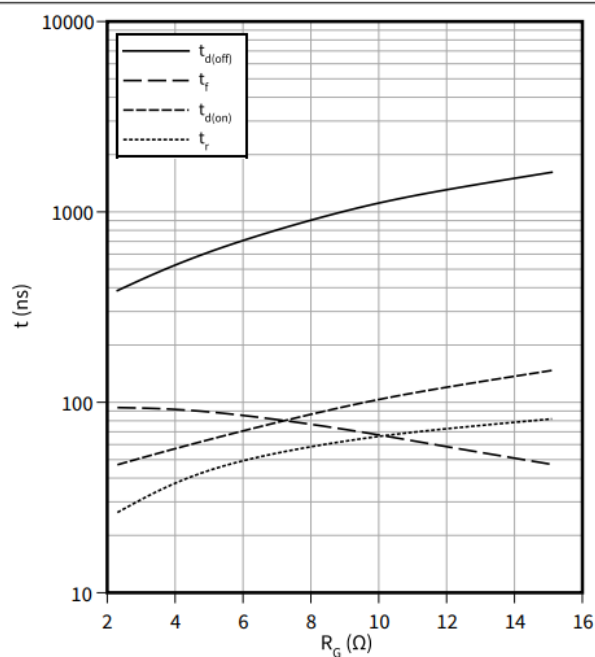
$$t = f(I_c)$$

$$V_{CC} = 600 \text{ V}, T_{vj} = 175 \text{ °C}, V_{GE} = 0/15 \text{ V}, R_G = 4.8 \text{ } \Omega$$


Typical switching times as a function of gate resistor

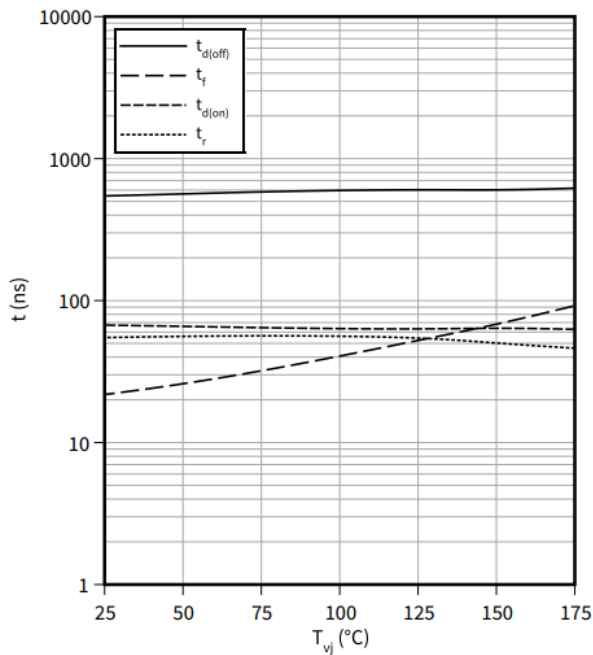
$$t = f(R_G)$$

$$I_c = 140 \text{ A}, V_{CC} = 600 \text{ V}, T_{vj} = 175 \text{ °C}, V_{GE} = 0/15 \text{ V}$$

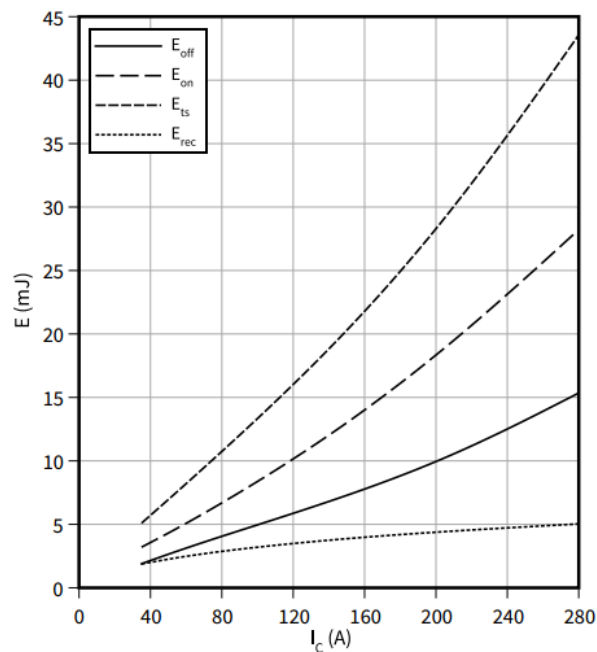


Typical switching times as a function of junction temperature

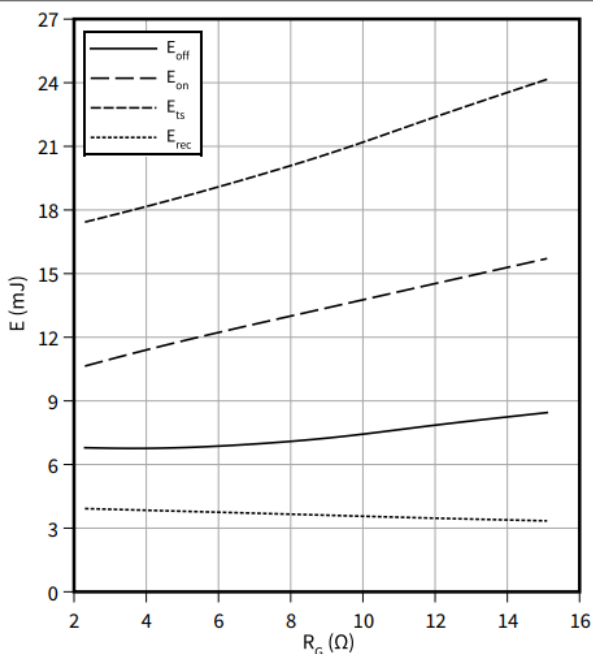
$$t = f(T_{vj})$$

 $I_C = 140\text{ A}, V_{CC} = 600\text{ V}, V_{GE} = 0/15\text{ V}, R_G = 4.8\ \Omega$

Typical switching energy losses as a function of collector current

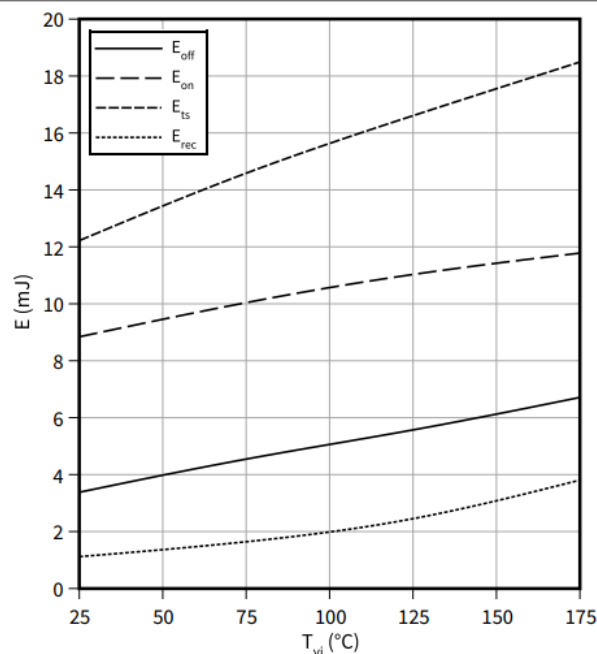
$$E = f(I_C)$$

 $V_{CC} = 600\text{ V}, T_{vj} = 175\text{ °C}, V_{GE} = 0/15\text{ V}, R_G = 4.8\ \Omega$

Typical switching energy losses as a function of gate resistor

$$E = f(R_G)$$

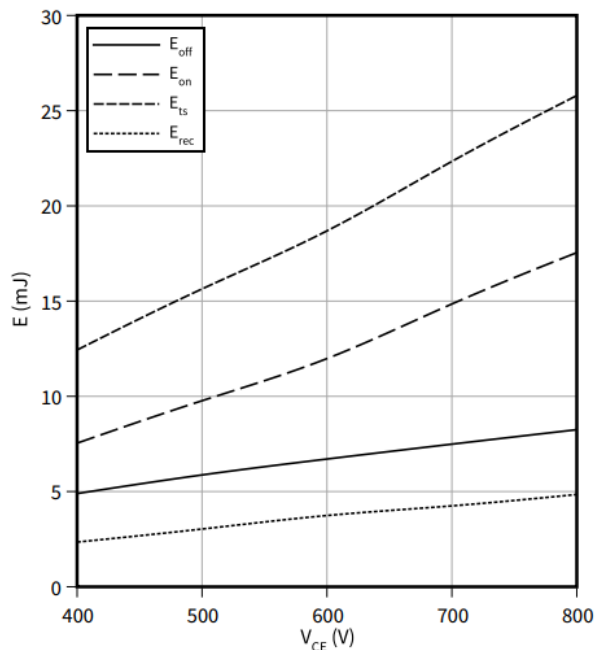
 $I_C = 140\text{ A}, V_{CC} = 600\text{ V}, T_{vj} = 175\text{ °C}, V_{GE} = 0/15\text{ V}$

Typical switching energy losses as a function of junction temperature

$$E = f(T_{vj})$$

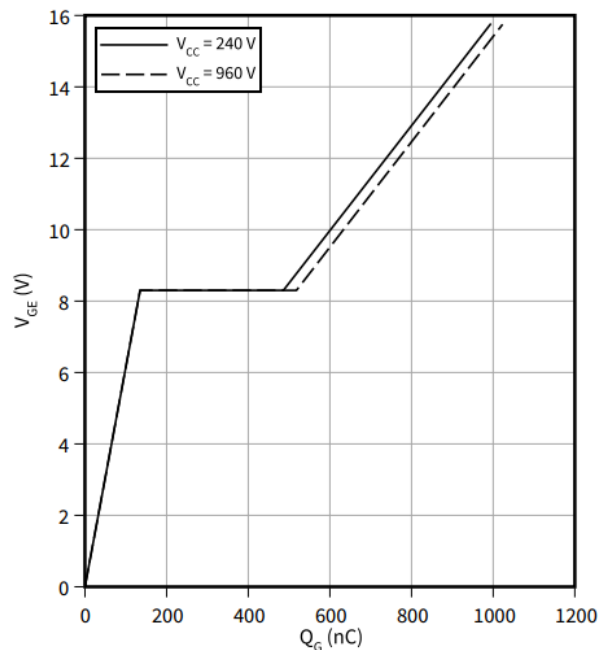
 $I_C = 140\text{ A}, V_{CC} = 600\text{ V}, V_{GE} = 0/15\text{ V}, R_G = 4.8\ \Omega$


Typical switching energy losses as a function of collector emitter voltage

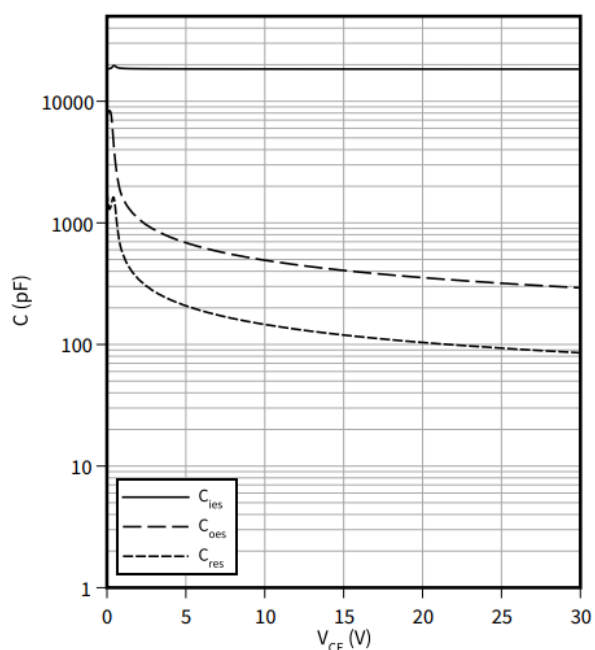
$$E = f(V_{CE})$$

 $I_C = 140\text{ A}, V_{GE} = 0/15\text{ V}, T_{vj} = 175\text{ }^\circ\text{C}, R_G = 4.8\text{ }\Omega$

Typical gate charge

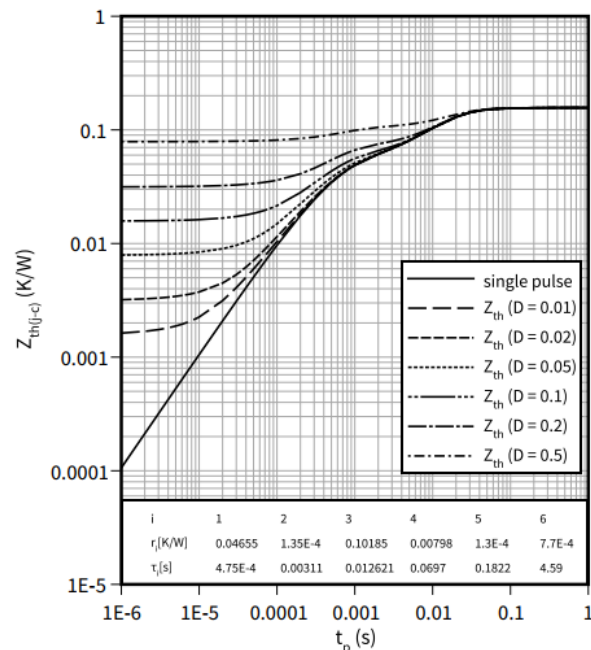
$$V_{GE} = f(Q_G)$$

 $I_C = 140\text{ A}$

Typical capacitance as a function of collector-emitter voltage

$$C = f(V_{CE})$$

 $f = 100\text{ kHz}, V_{GE} = 0\text{ V}$

IGBT transient thermal impedance as a function of pulse width

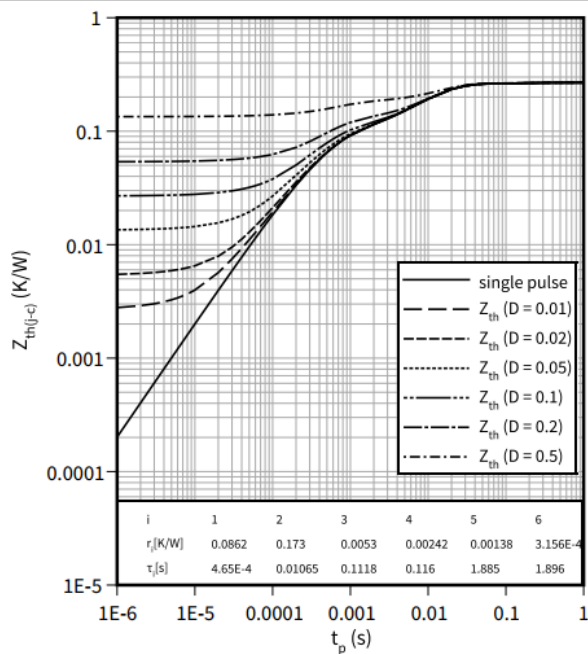
$$Z_{th(j-c)} = f(t_p)$$

 $D = t_p/T$


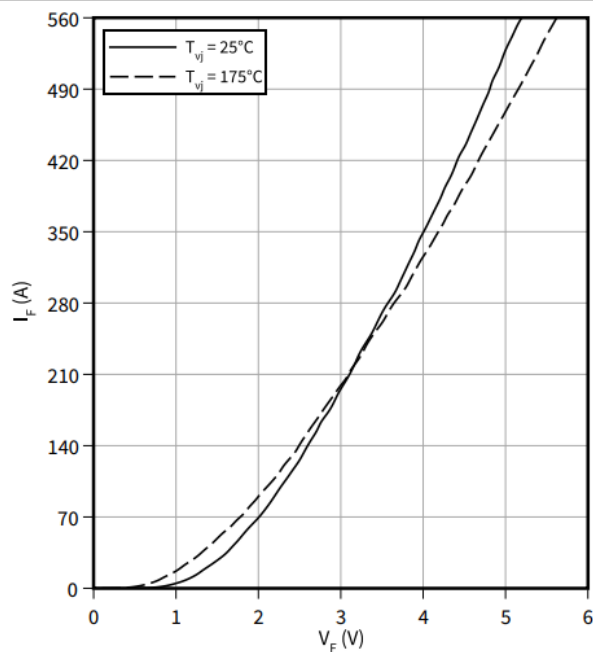
Diode transient thermal impedance as a function of pulse width

$$Z_{th(j-c)} = f(t_p)$$

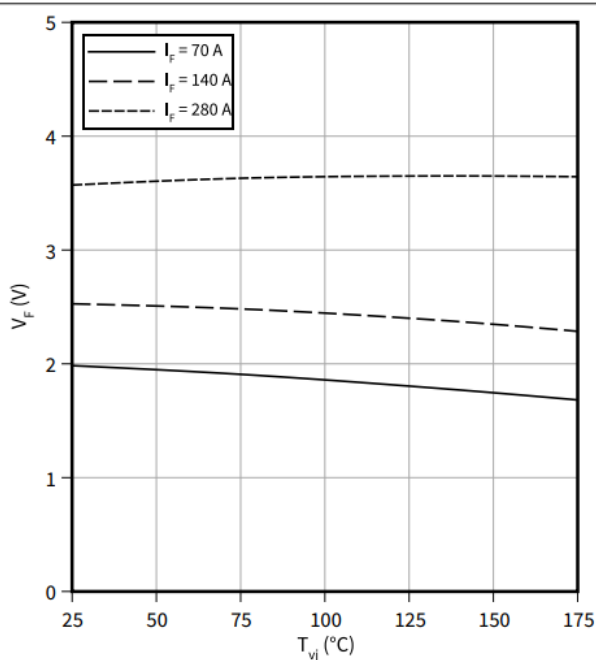
$$D = t_p/T$$


Typical diode forward current as a function of forward voltage

$$I_F = f(V_F)$$

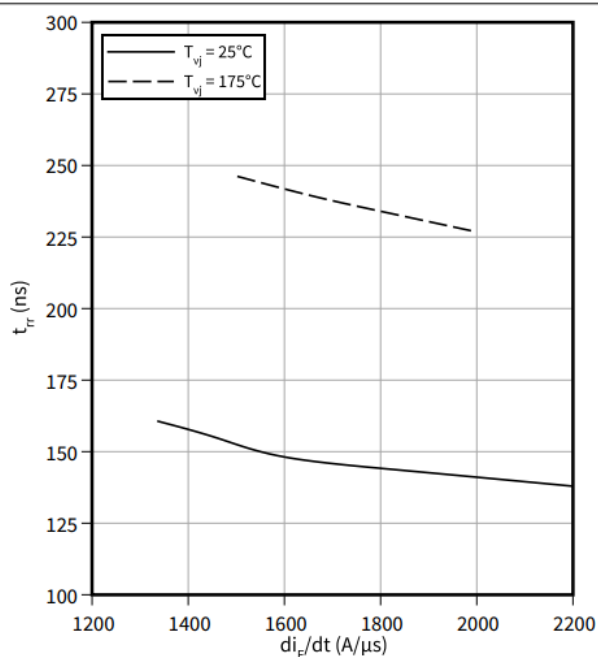

Typical diode forward voltage as a function of junction temperature

$$V_F = f(T_{vj})$$


Typical reverse recovery time as a function of diode current slope

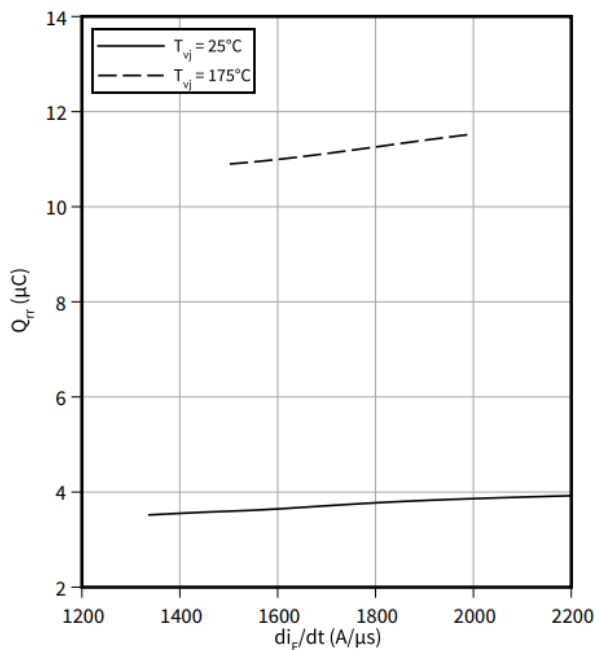
$$t_{rr} = f(di_F/dt)$$

$$V_R = 600 \text{ V}, I_F = 140 \text{ A}$$

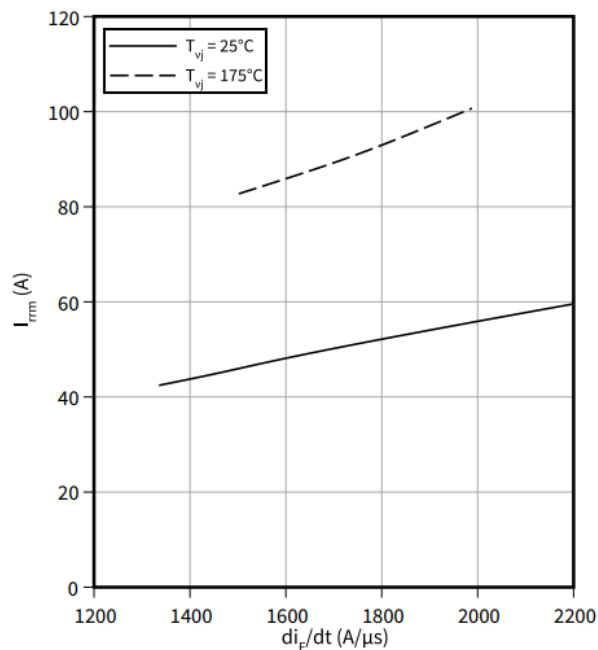


Typical reverse recovery charge as a function of diode current slope

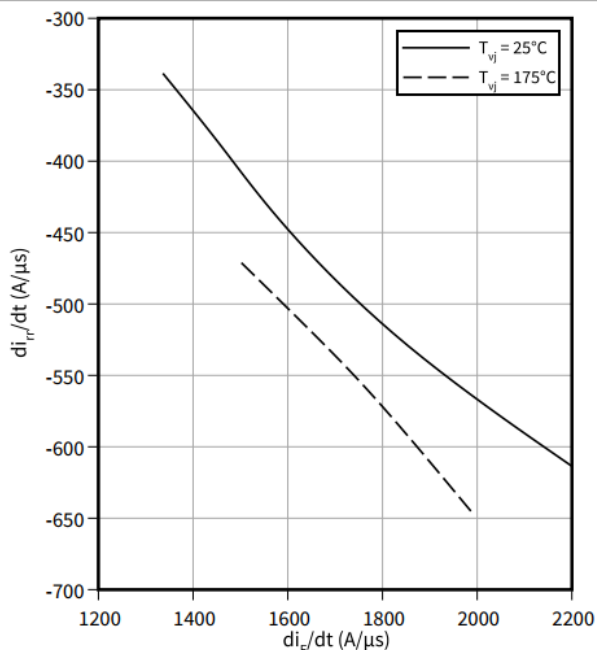
$$Q_{rr} = f(di_F/dt)$$

 $V_R = 600\text{ V}, I_F = 140\text{ A}$

Typical reverse recovery current as a function of diode current slope

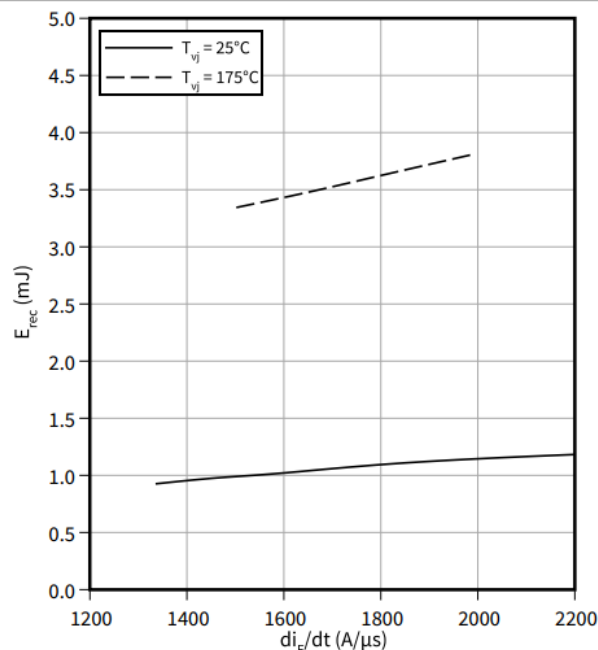
$$I_{rrm} = f(di_F/dt)$$

 $V_R = 600\text{ V}, I_F = 140\text{ A}$

Typical diode peak rate of fall of reverse recovery current as a function of diode current slope

$$di_{rr}/dt = f(di_F/dt)$$

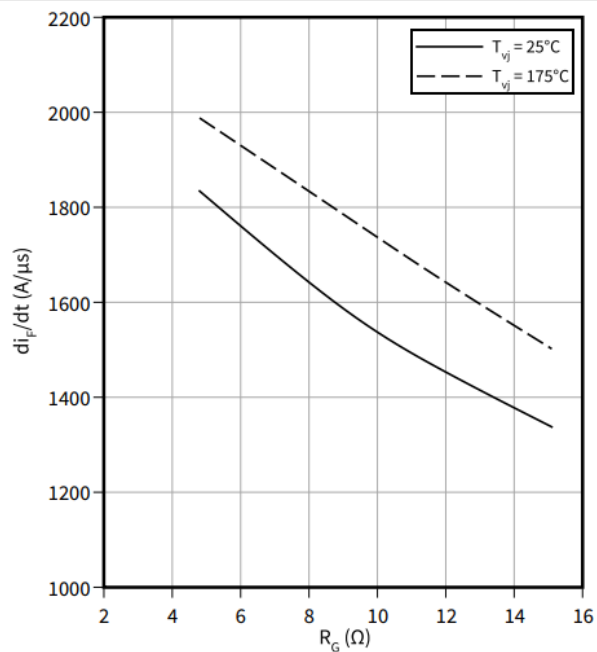
 $V_R = 600\text{ V}, I_F = 140\text{ A}$

Typical reverse energy losses as a function of diode current slope

$$E_{rec} = f(di_F/dt)$$

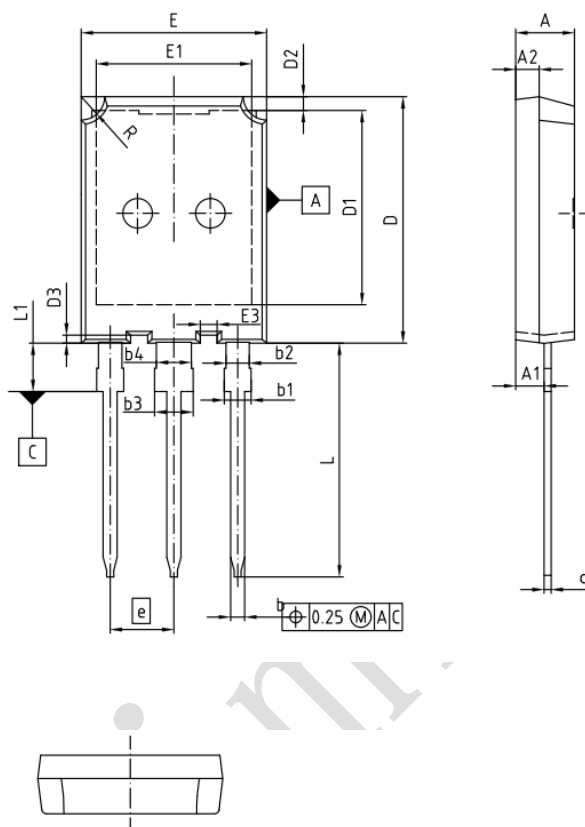
 $V_R = 600\text{ V}, I_F = 140\text{ A}$


Typical diode current slope as a function of gate resistor

$$di_F/dt = f(R_G)$$

 $V_R = 600\text{ V}, I_F = 140\text{ A}$


Package Outline TO247PLUS



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.90	5.10	0.193	0.201
A1	2.31	2.51	0.091	0.099
A2	1.90	2.10	0.075	0.083
b	1.16	1.26	0.046	0.050
b1	1.96	2.25	0.077	0.089
b2	1.96	2.06	0.077	0.081
c	0.59	0.66	0.023	0.026
D	20.90	21.10	0.823	0.831
D1	16.25	16.85	0.640	0.663
D2	1.05	1.35	0.041	0.053
D3	0.58	0.78	0.023	0.031
E	15.70	15.90	0.618	0.626
E1	13.10	13.50	0.516	0.531
E3	1.35	1.55	0.053	0.061
e	5.44 (BSC)		0.214 (BSC)	
N	3		3	
L	19.80	20.10	0.780	0.791
L1	-	4.30	-	0.169
R	1.90	2.10	0.075	0.083

DOCUMENT NO. SLC247 Plus-3006	
SCALE	0 5 5 7.5mm
ASIAN PROJECTION	
ISSUE DATE 13-08-2019	
REVISION 01	

Revision History

Revision	Date	Major Changes
Preliminary	2024-8-26	Release of provisional version

Disclaimer

Unless otherwise specified in the datasheet, the product is designed and qualified as a standard commercial product and is not intended for use in applications that require extraordinary levels of quality and reliability, such as automotive, aviation/aerospace and life-support devices or systems.

Any and all semiconductor products have certain probability to fail or malfunction, which may result in personal injury, death or property damage. Customer are solely responsible for providing adequate safe measures when design their systems.

Scilicon Electric reserves the right to improve product design, function and reliability without notice.