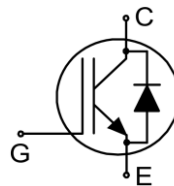


Features

- $V_{CE} = 1200\text{ V}$
- $I_C = 160\text{ A}$
- Maximum junction temperature $T_{vjmax} = 150^\circ\text{C}$
- Low saturation voltage $V_{CEsat} = 1.6\text{ V}$ at $T_{vj} = 25^\circ\text{C}$
- V_{CEsat} is a positive temperature coefficient, suitable for parallel applications



Package Type



TO-247Plus-4L

Application

- Uninterruptible power supply
- EV-Charging
- String inverter
- Welding

Symbol

Ordering Information

Type	Package	Marking	Outline	Media	Quantity(pcs)
HPI160Z120FSHG1	TO-247Plus-4L			Tube	30

Absolute Maximum Ratings

Parameter		Symbol	Rating	Unit
Collector-emitter voltage ($T_{vj} \geq 25^\circ\text{C}$)		V_{CE}	1200	V
Gate-emitter voltage		V_{GE}	± 20	V
DC collector current, limited by T_{vjmax}	$T_c = 25^\circ\text{C}$	I_C	200	A
	$T_c = 100^\circ\text{C}$		160	
Pulsed collector current, tp limited by T_{vjmax}		I_{Cpulse}	640	A
Diode forward current, limited by T_{vjmax}	$T_c = 25^\circ\text{C}$	I_F	200	A
	$T_c = 100^\circ\text{C}$		160	
Diode pulsed current, tp limited by T_{vjmax}		I_{Fpulse}	640	A
Power dissipation	$T_c = 25^\circ\text{C}$	P_{tot}	1562	W
	$T_c = 100^\circ\text{C}$		625	
Junction temperature range		T_J	$-40 \sim 150$	$^\circ\text{C}$
Storage temperature range		T_{STG}	$-40 \sim 150$	$^\circ\text{C}$

Thermal Resistance

Parameter		Symbol	Value	Unit
IGBT thermal resistance, junction-case	TO-247Plus-4L	R_{thJC}	0.067	°C/W
Diode thermal resistance, junction-case	TO-247Plus-4L	R_{thJC}	0.135	°C/W

Electrical Characteristics

$T_J = 25^{\circ}\text{C}$, unless otherwise specified.

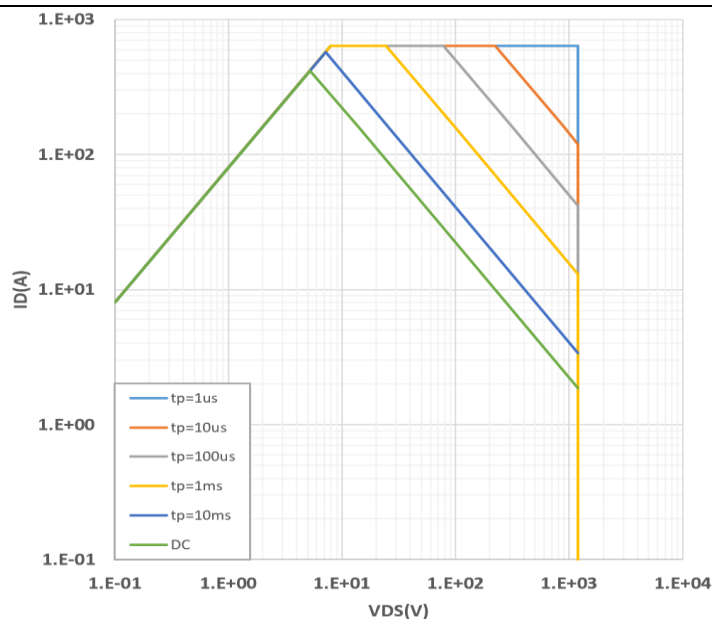
Parameter	Symbol	Test Conditions		Min	Typ	Max	Unit
Statistic Characteristics							
Collector-emitter Breakdown Voltage	V _{(BR)CES}	V _{GE} =0V, I _C =250uA		1200			V
Collector cut-off current	I _{CES}	V _{CE} =1200V, V _{GS} =0V				10	μA
Gate-emitter leakage current	I _{GES}	V _{GE} =±20V, V _{GE} =0V				100	nA
Gate Threshold Voltage	V _{GE(TH)}	V _{CE} =V _{GE} , I _C =2.5mA		4.7	5.3	6.2	V
Collector-emitter saturation voltage	V _{CE(sat)}	V _{GE} =15V, I _C =160A	T _J =25℃		1.5	1.9	V
			T _J =125℃		1.8	2.2	V
			T _J =175℃		2.0	2.4	V
Forward on-Voltage	V _F	I _F =160A,V _{GE} =0V			2.5	3.5	V
Dynamic Characteristics							
Input Capacitance	C _{IES}	V _{CE} =25V, V _{GE} =0V, f=0.1MHz			18.57		nF
Output Capacitance	C _{OES}				372		pF
Reverse Transfer Capacitance	C _{RES}				111		pF
Switching Parameters							
Turn-on Delay Time	t _{d(on)}	V _{CE} =600V I _C =160A R _G =4.7Ω, V _{GE} =+15V/-8V	T _J =25℃		72.9		ns
			T _J =125℃		68.5		ns
			T _J =175℃		66.6		ns
Rise Time	t _r	V _{CE} =600V I _C =160A R _G =4.7Ω, V _{GE} =+15V/-8V	T _J =25℃		33.3		ns
			T _J =125℃		36.0		ns
			T _J =175℃		35.0		ns
Turn-off Delay Time	t _{d(off)}	V _{CE} =600V I _C =160A R _G =4.7Ω, V _{GE} =+15V/-8V	T _J =25℃		287.0		ns
			T _J =125℃		306.1		ns
			T _J =175℃		329.0		ns

Fall Time	t _f	VCE=600V I _C =160A R _G =4.7Ω, V _{GE} =+15V/ -8V	T _J =25℃		64.0		ns
			T _J =125℃		96.6		ns
			T _J =175℃		108.1		ns
Turn-on switching energy	E _{on}	VCE=600V I _C =160A R _G =4.7Ω, V _{GE} =+15V/ -8V	T _J =25℃		5.53		mJ
			T _J =125℃		8.3		mJ
			T _J =175℃		10.1		mJ
Turn-off switching energy	E _{off}	VCE=600V I _C =160A R _G =4.7Ω, V _{GE} =+15V/ -8V	T _J =25℃		5.83		mJ
			T _J =125℃		7.77		mJ
			T _J =175℃		8.75		mJ
Diode reverse recovery time	T _{rr}	V _R =600 V, R _G =4.7Ω, I _F =160A, di/dt=1400A/us			210		ns
Diode reverse recovery charge	Q _{rr}				3.7		μC
Diode peak reverse recovery current	I _{rrm}				38.4		A
Reverse recovery energy	E _{rec}				0.87		mJ
Gate Charge Characteristics							
Gate Charge Total	Q _g	V _{CC} =960V, I _C =160A V _{GE} =0 to 15V			802		nC

Typical Performance Characteristics

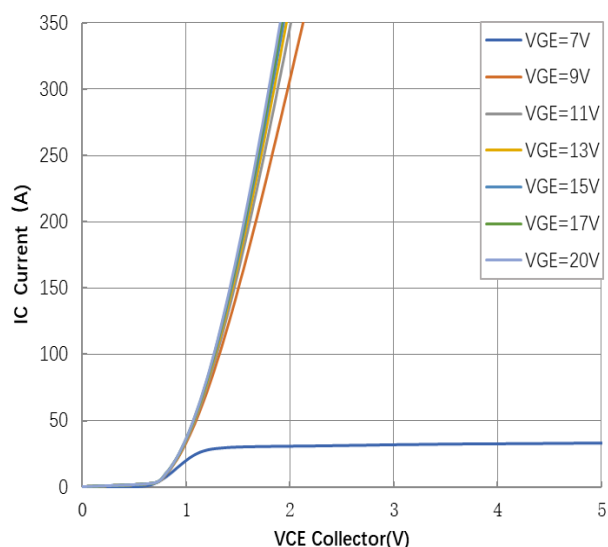
Reverse bias safe operating area

$I_C = f(V_{CE})$, $I_C = f(V_{CE})$, $T_j \leq 175^\circ\text{C}$, $V_{GE} = 0/15\text{ V}$



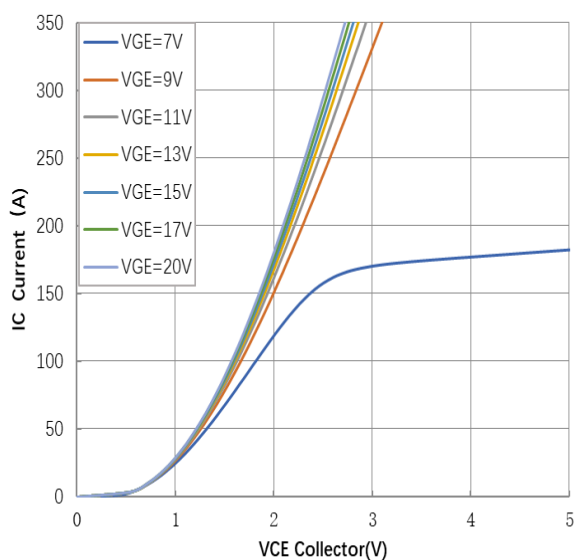
Typical output characteristic

$I_C = f(V_{CE})$, $T_j = 25^\circ\text{C}$



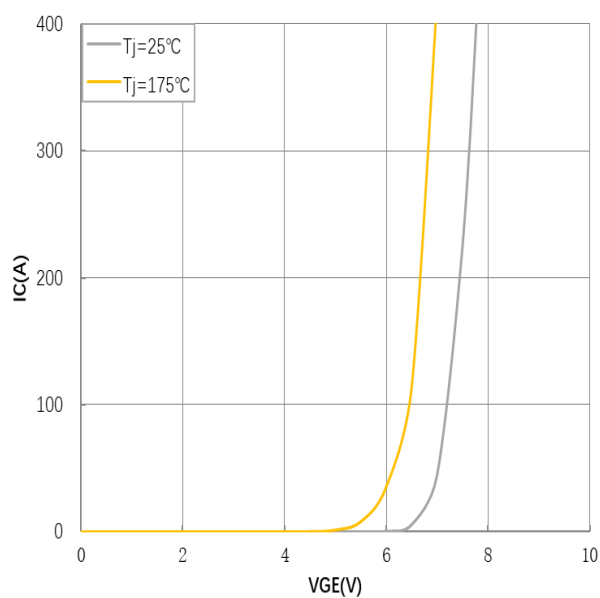
Typical output characteristic

$I_C = f(V_{CE})$, $T_j = 175^\circ\text{C}$



Typical transfer characteristic

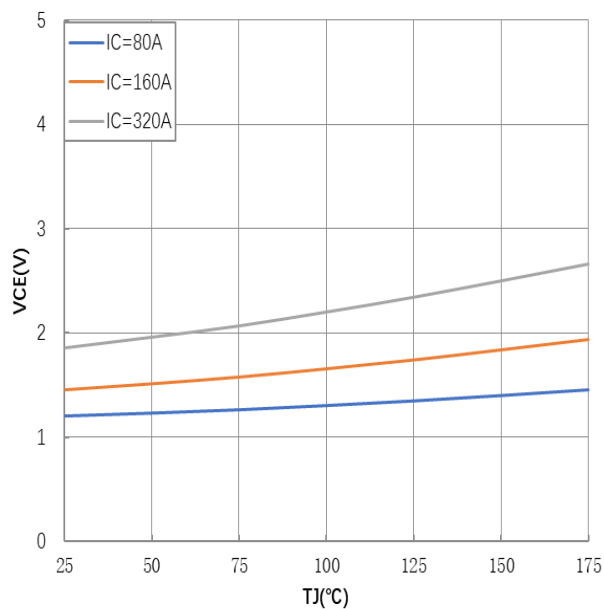
$I_C = f(V_{GE})$, $V_{CE}=20\text{ V}$



Typical Performance Characteristics

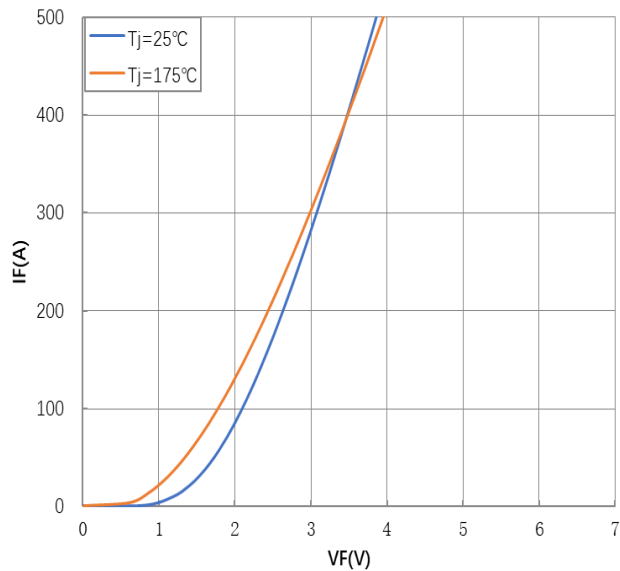
Typical collector-emitter saturation voltage as a function of junction temperature

$$V_{CE} = f(T_j), V_{GE} = 15 \text{ V}$$



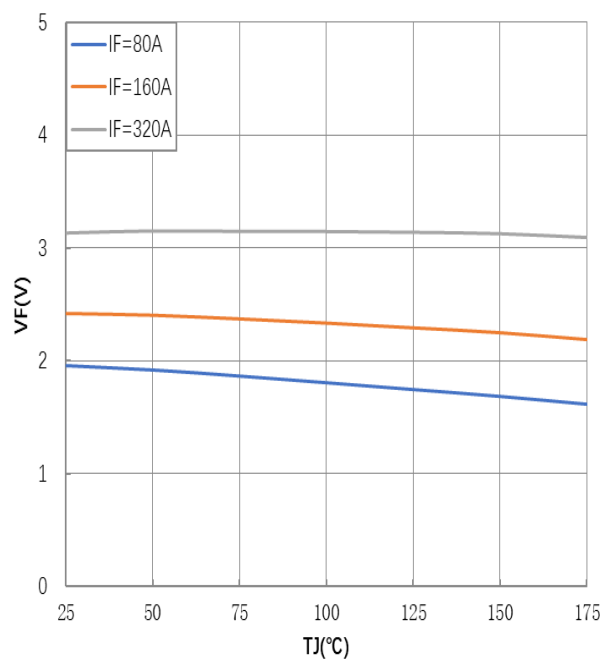
Typical diode forward current as a function of forward voltage

$$I_F = f(V_F)$$



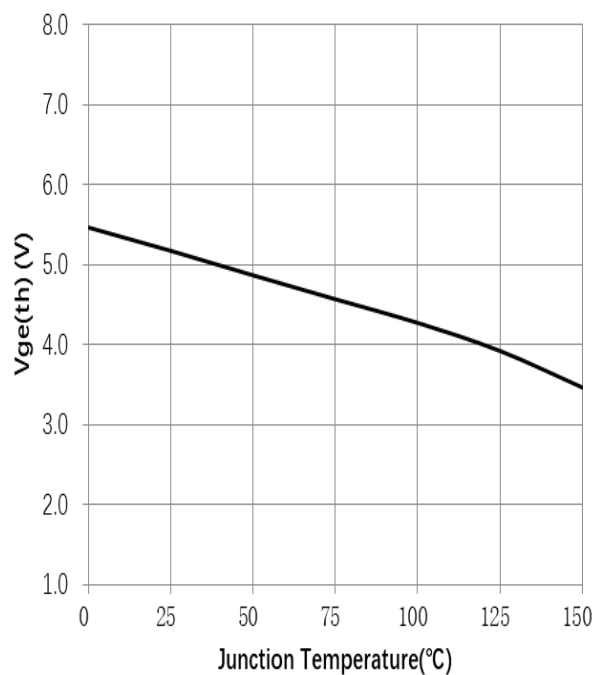
Typical diode forward voltage as a function of junction temperature

$$V_F = f(T_j), V_{GE} = 0 \text{ V}$$



Gate-emitter threshold voltage as a function of junction temperature

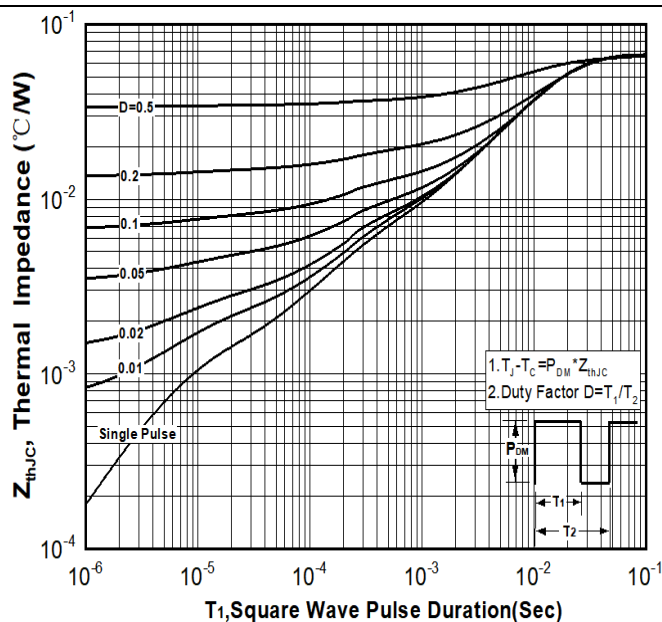
$$V_{GEth} = f(T_j), I_C = 2.5 \text{ mA}$$



Typical Performance Characteristics

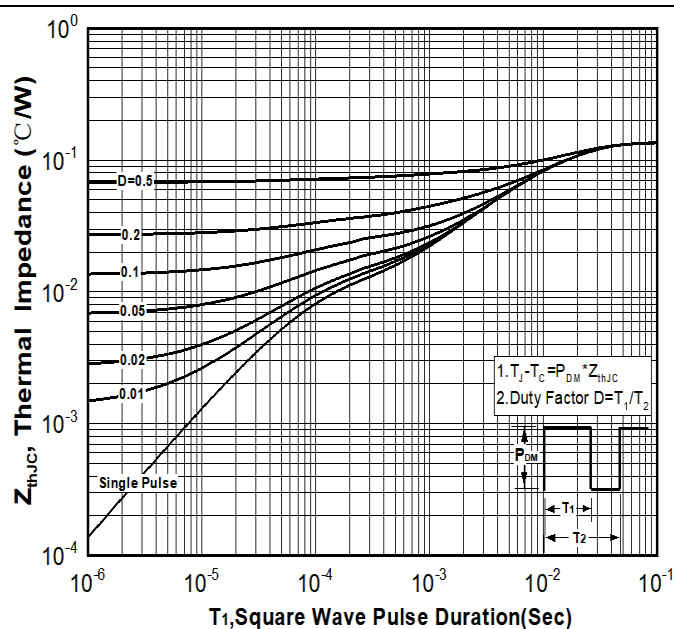
IGBT transient thermal impedance as a function of pulse width

$$Z_{th(j-c)} = f(tp), D = tp/T$$



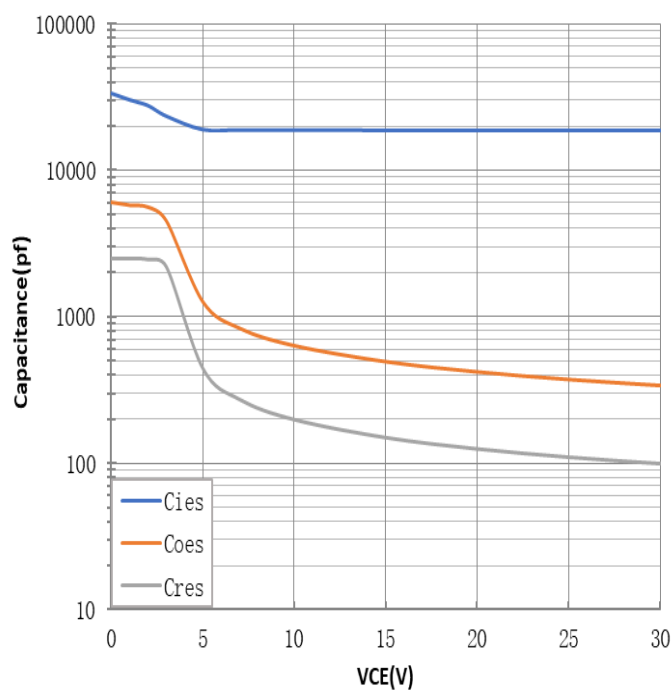
Diode transient thermal impedance as a function of pulse width

$$Z_{th(j-c)} = f(tp), D = tp/T$$



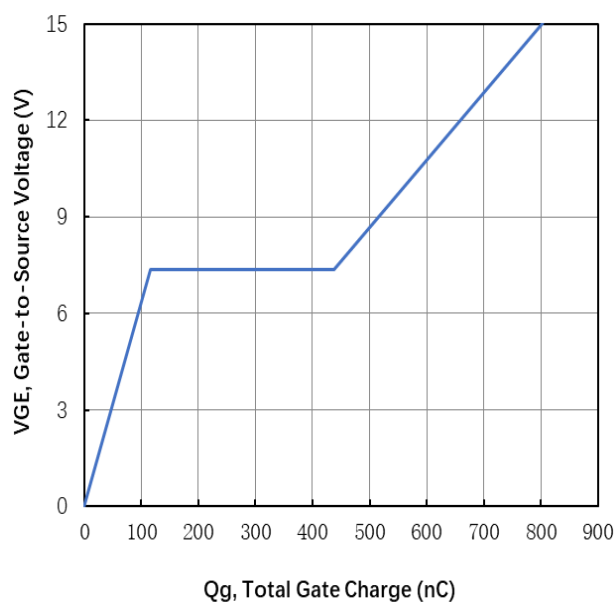
Typical capacitance as a function of collector-emitter voltage

$$C = f(V_{CE}), f = 100 \text{ kHz}, V_{GE} = 0 \text{ V}$$



Typical gate charge

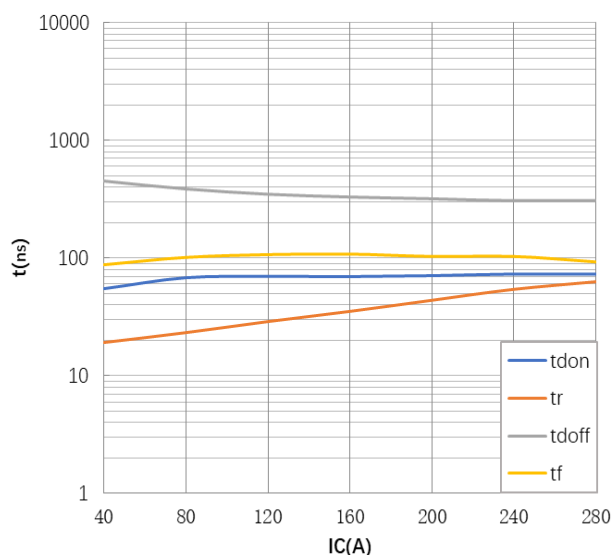
$$V_{GE} = f(Q_g), V_{CE} = 960 \text{ V}, I_C = 160 \text{ A}$$



Typical Performance Characteristics

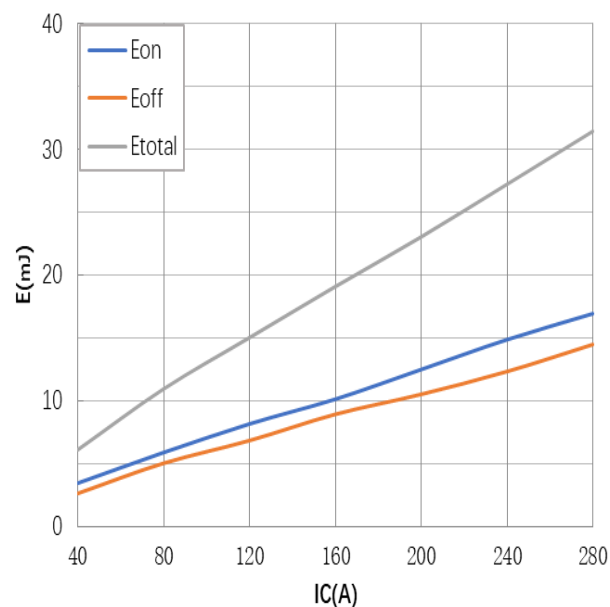
Typical switching times as a function of collector current

$t = f(I_C)$, $V_{CE}=600V$, $R_g=4.7\Omega$, $V_{GE}=-8V/15V$, $L=45\mu H$,
 $T_J=175^\circ C$



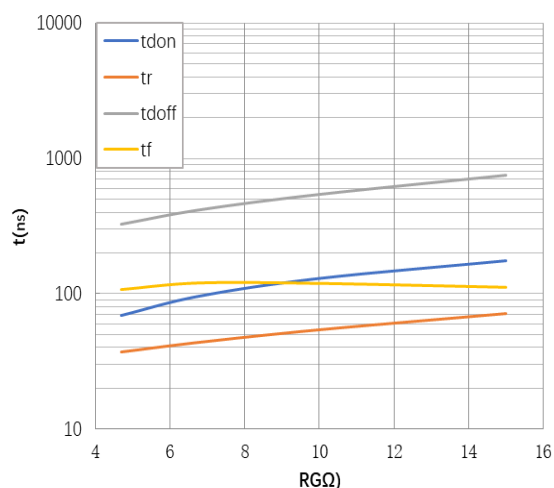
Typical switching energy losses as a function of collector current

$E = f(I_C)$, $V_{CE}=600V$, $R_g=4.7\Omega$, $V_{GE}=-8V/15V$, $L=45\mu H$,
 $T_J=175^\circ C$



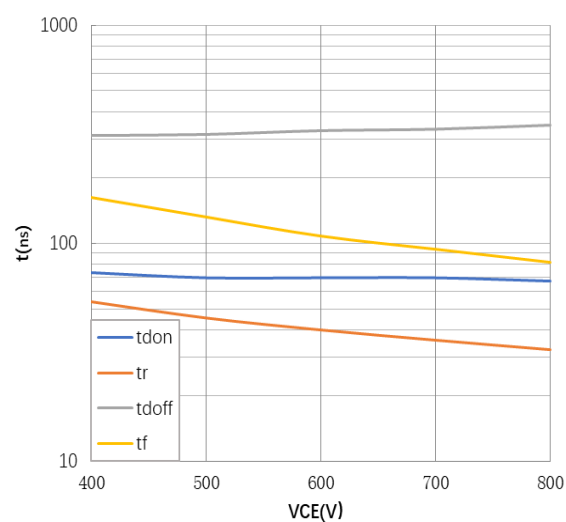
Typical switching times as a function of gate resistor

$t = f(R_g)$, $V_{CC}=600V$, $I_C=160A$, $T_J=175^\circ C$, $V_{GE}=-8/15V$,
 $L=45\mu H$



Typical switching times as a function of collector emitter voltage

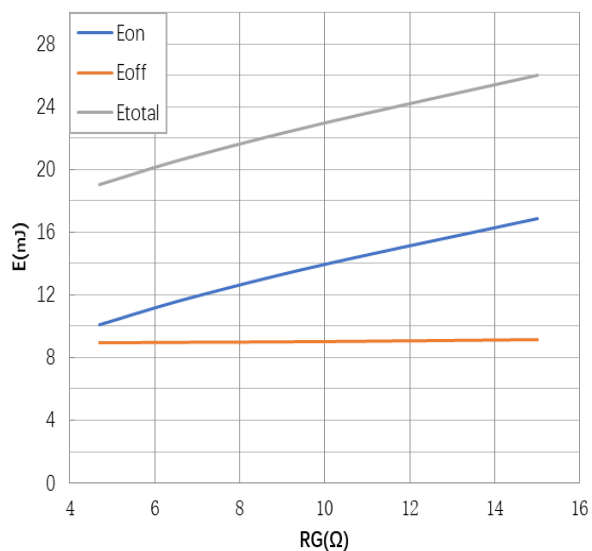
$t = f(V_{CE})$, $I_C=160A$, $R_g=4.7\Omega$, $V_{GE}=-8/15V$, $T_J=175^\circ C$,
 $L=45\mu H$



Typical Performance Characteristics

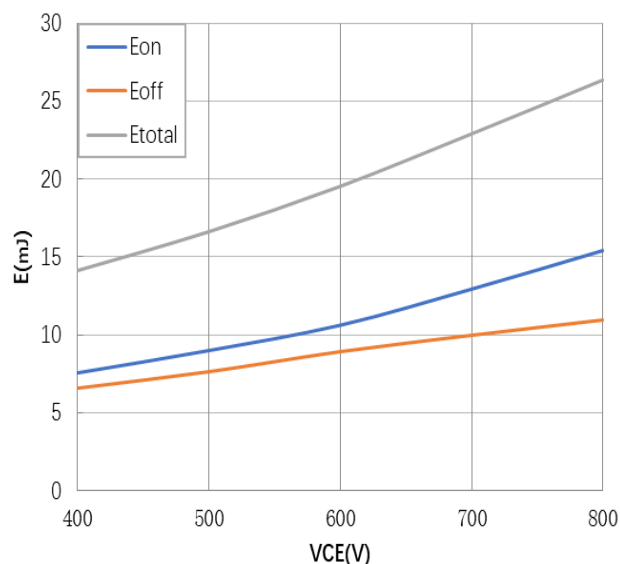
Typical switching energy losses as a function of gate resistor

$E = f(R_G)$, $V_{CC}=600V$, $I_C=160A$, $T_J=175^{\circ}C$, $V_{GE}=-8/15V$,
 $L=45\mu H$



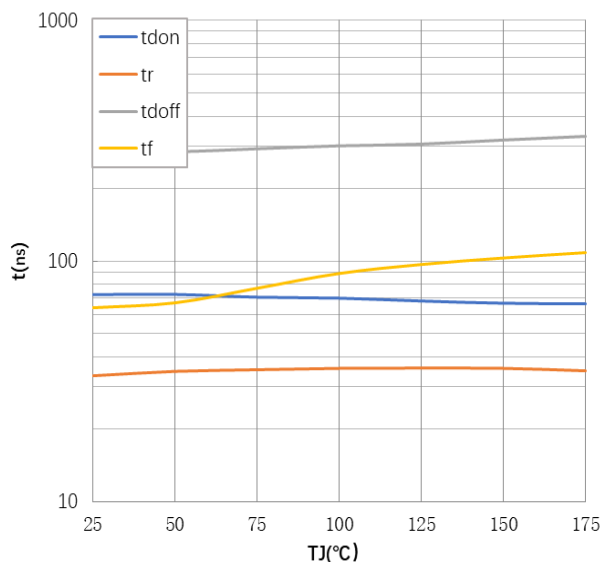
Typical switching energy losses as a function of collector emitter voltage

$E = f(V_{CE})$, $I_C=160A$, $R_G=4.7\Omega$, $V_{GE}=-8/15V$, $T_J=175^{\circ}C$,
 $L=45\mu H$



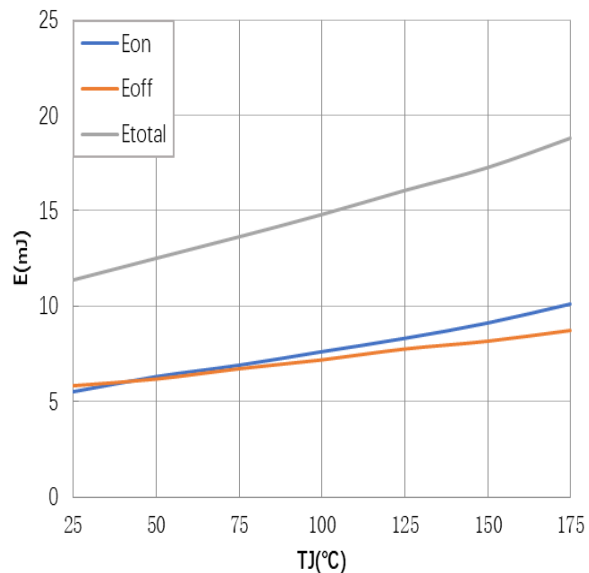
Typical switching times as a function of junction temperature

$t = f(T_J)$, $V_{CE}=600V$, $R_G=4.7\Omega$, $V_{GE}=-8V/15V$,
 $I_C=160A$, $L=45\mu H$



Typical switching energy losses as a function of junction temperature

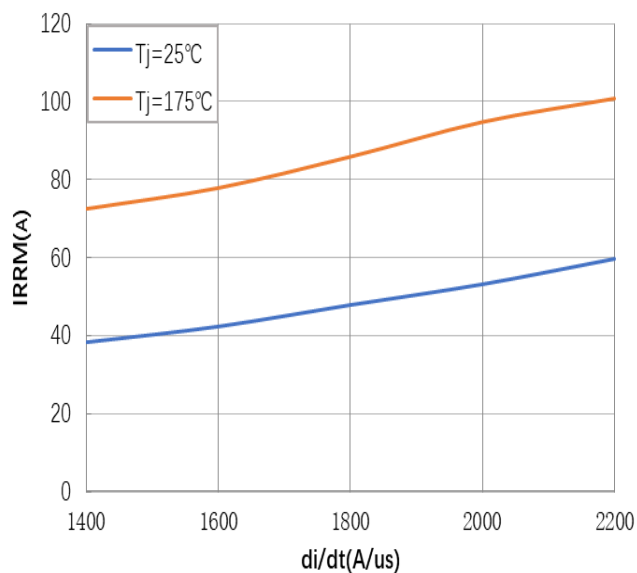
$E = f(T_J)$, $V_{CC}=600V$, $I_C=160A$, $R_G=4.7\Omega$, $V_{GE}=-8/15V$,
 $L=45\mu H$



Typical Performance Characteristics

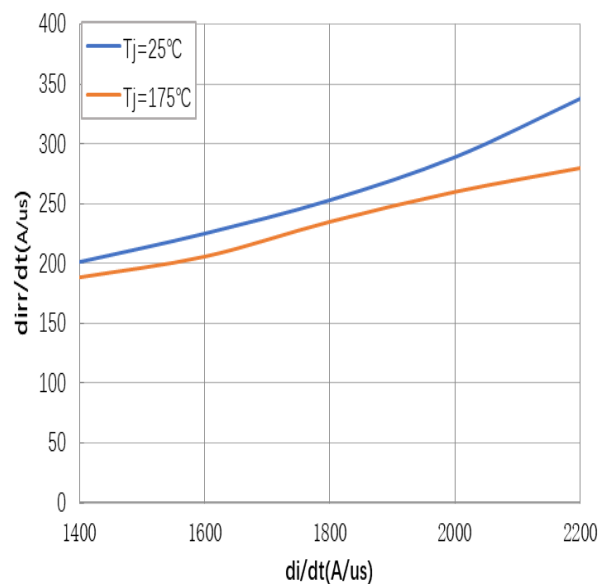
Typical reverse recovery current as a function of diode current slope

$$I_{RRM} = f(diF/dt), V_R=600V, V_{GE}=-8V, I_F=160A$$



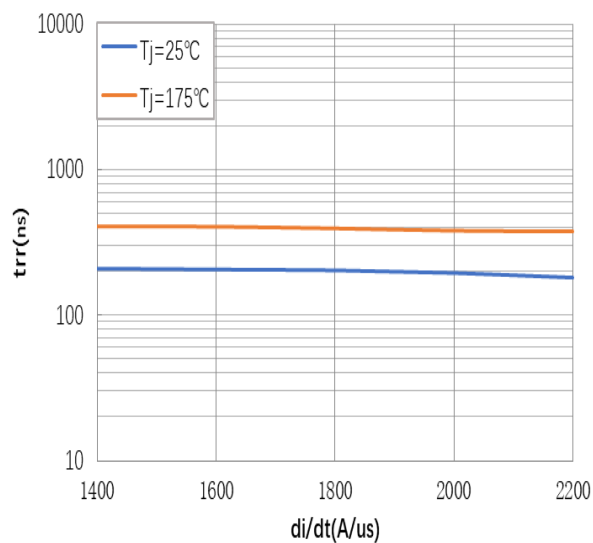
Typical diode peak rate of fall of reverse recovery current as a function of diode current slope

$$di_{rr}/dt = f(diF/dt), V_R=600V, V_{GE}=-8V, I_F=160A$$



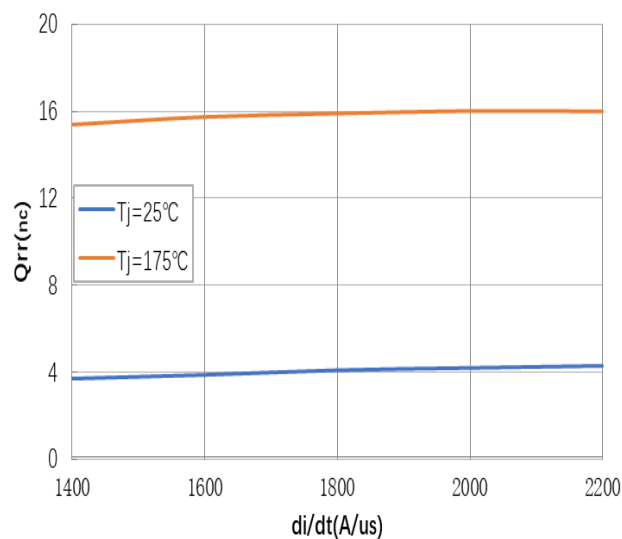
Typical reverse recovery time as a function of diode current slope

$$t_{rr} = f(diF/dt), V_R=600V, V_{GE}=-8V, I_F=160A$$



Typical reverse recovery charge as a function of diode current slope

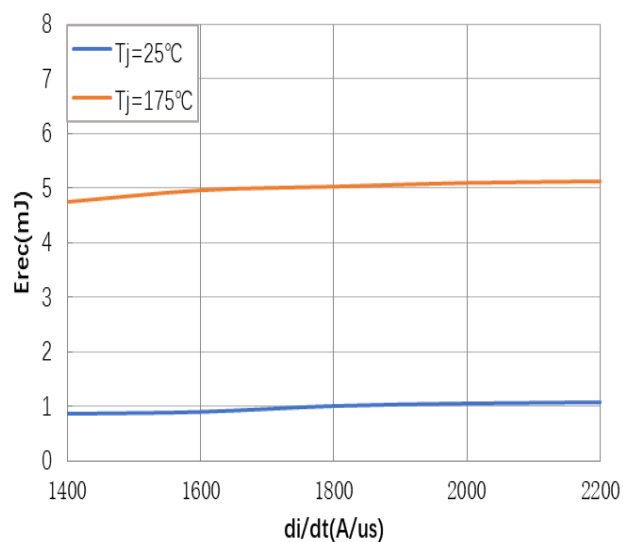
$$Q_{rr} = f(diF/dt), V_R=600V, V_{GE}=-8V, I_F=160A$$



Typical Performance Characteristics

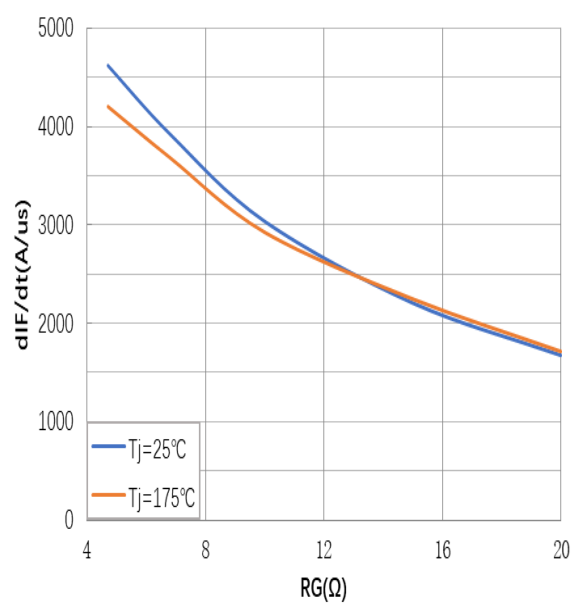
Typical reverse energy losses as a function of diode current slope

$E_{rec} = f(diF/dt)$, $V_R=600V$, $V_{GE}=-8V$, $I_F=160A$



Typical diode current slope as a function of gate resistor

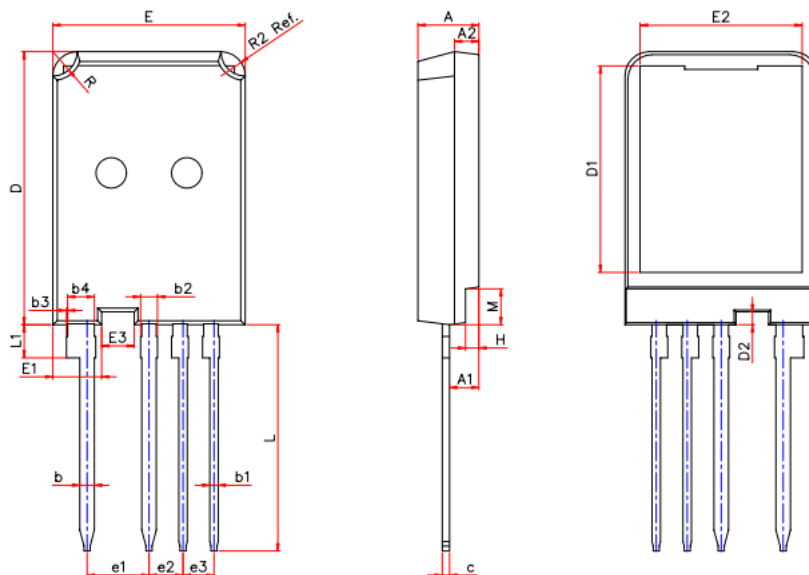
$diF/dt = f(R_G)$, $V_R=600V$, $V_{GE}=-8V$, $I_F=160A$



Mechanical Dimensions(Continued)

TO247-4-PLUS

Unit: mm



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	4.900	5.100	0.193	0.201
A1	2.310	2.510	0.091	0.099
A2	1.900	2.100	0.075	0.083
b	1.160	1.290	0.046	0.051
b1	0.650	0.790	0.026	0.031
b2	1.360	1.490	0.054	0.059
b3	0.000	0.200	0.000	0.008
b4	2.160	2.290	0.085	0.090
c	0.590	0.660	0.023	0.026
D	22.300	22.500	0.878	0.886
D1	16.650	17.250	0.656	0.679
D2	1.000	1.100	0.039	0.043
E	15.700	15.900	0.618	0.626
E1	3.900	4.100	0.154	0.161
E2	13.100	13.500	0.516	0.531
E3	2.580	2.780	0.102	0.109
e1	5.080 BSC		0.200 BSC	
e2	2.790 BSC		0.106 BSC	
e3	2.540 BSC		0.100 BSC	
H	1.000	1.200	0.039	0.047
L	18.460	18.660	0.727	0.735
L1	2.620	2.820	0.103	0.111
M	2.850	3.050	0.112	0.120
R	1.900	2.100	0.075	0.083

Document Change History

Doc. Rev.	Tech Dev. Rev.	Effective Date	Change Description
0.1		2025-2-21	0.1 version specification sheet