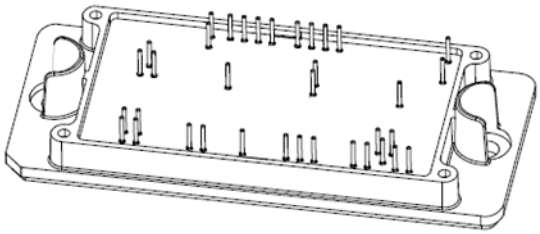
Electrical Features

- Neutral Point Clamped Three−Level Inverter Module
- Low Inductive Layout
- Solderable Pins
- Higher System Efficiency
- Reduced Cooling Requirements
- Low Conduction Losses Over Temperature



Typical Applications

- Solar Inverters
- Uninterruptable Power Supplies Systems

Table 1 Absolute Maximum Ratings（Ta=25℃）

Outer IGBT(Q1,Q4)							
Maximum Rated Values							
Symbol	Item	Conditions			Rating		Unit
V_{CES}	Collector-emitter voltage	T_{vj}=25℃			650		V
V_{GES}	Gate-emitter voltage	-			±20		V
I_C	Continuous Collector Current	T_C=80℃,T_{vj}=175℃			270		A
I_{CP}	Pulsed Collector Current	T_{vj}=175℃			810		A
T_{vj}	Junction Temperature	-			-40 to +175		℃
Characteristics Values							
Symbol	Item	Conditions		Values			Unit
IGBT				Min.	Typ.	Max.	
I_{CES}	Collector-emitter cut-off current	V_{CE}=650V,V_{GE}=0V,T_{vj}=25℃		-	-	100	uA
I_{GES}	Gate leakage current	V_{CE}=0V,V_{GE}=20V,T_{vj}=25℃		-	-	100	nA
$V_{(BR)CES}$	Collector-emitter voltage	V_{GE}=0V, T_{vj}=25℃		650	-	-	V
$V_{GE(th)}$	Gate-emitter threshold voltage	I_C=8mA,V_{CE}=V_{GE},T_{vj}=25℃		3.5	4.18	6.4	V
V_{CEsat}	Collector-emitter saturation voltage	I_C=450A V_{GE}=15V	T_{vj}=25℃	-	1.42	3	V
			T_{vj}=125℃	-	1.59	-	
			T_{vj}=150℃	-	-	-	
C_{ies}	Input capacitance	V_{CE}=20V,V_{GE}=0V f=10KHz,T_{vj}=25℃		-		-	nF
C_{oes}	Output capacitance			-		-	
C_{res}	Reverse transfer capacitance			-		-	
Q_G	Gate charge	V_{GE}=-8/+15V		-	0.63	-	uC

$t_{d(on)}$	Turn-on delay time	V_{CE}=400V, I_C=450A, V_{GE}=-8V/+15V, $R_{G(on)}$=15 Ω , $R_{G(off)}$=20 Ω	T_{vj}=25°C	-	84	-	us
			T_{vj}=125°C	-	68	-	
			T_{vj}=150°C	-		-	
t_r	Rise time		T_{vj}=25°C	-	136	-	
			T_{vj}=125°C	-	136	-	
			T_{vj}=150°C	-		-	
$t_{d(off)}$	Turn-off delay time		T_{vj}=25°C	-	746	-	
			T_{vj}=125°C	-	790	-	
			T_{vj}=150°C	-		-	
t_f	Fall time		T_{vj}=25°C	-	128	-	
			T_{vj}=125°C	-	132	-	
			T_{vj}=150°C	-		-	
E_{on}	Turn-on energy (per pulse)	V_{CE}=400V, I_C=450A, V_{GE}=-8V/+15V, $R_{G(on)}$=15 Ω , $R_{G(off)}$=20 Ω	T_{vj}=25°C	-	7.3	-	mJ
			T_{vj}=125°C	-	10.3	-	
			T_{vj}=150°C	-		-	
E_{off}	Turn-off energy (per pulse)		T_{vj}=25°C	-	31.6	-	
			T_{vj}=125°C	-	33.6	-	
			T_{vj}=150°C	-		-	
SC data	Short-circuit current	V_{CC}=400V,V_{GE}≤15V,T_{vj}=150°C, t_P≤10μs		-	-	-	A
R_{thJC}	Thermal resistance,chip to case	per IGBT/ λgrease=2.8W/(m·K)		-		-	K/W
R_{thJH}	Thermalresistance, chip to heatsink			-		-	K/W

Neutral Point Diode(D5,D6)

Maximum Rated Values

Symbol	Item	Conditions	Rating	Unit
V_{RRM}	Repetitive peak reverse voltage	T_{vj}=25°C	650	V
I_F	Forward current,DC	T_C=80°C,T_{vj}=175°C	230	A
I_{FRM}	Repetitive peak forward current	T_{vj}=175°C	690	A
T_{vj}	Junction Temperature	-	-40 to +175	°C

Characteristic Values

				Min.	Typ.	Max.	
V_F	Continuous forward voltage	I_F=450A V_{GE}=0V	T_{vj}=25°C	-	1.55	3	V
			T_{vj}=125°C	-	1.59	-	
			T_{vj}=150°C	-		-	
I_{RM}	Peak reverse recovery current	V_{CE}=400V, I_C=450A, V_{GE}=-8V/+15V, $R_{G(on)}$=15 Ω , $R_{G(off)}$=20 Ω	T_{vj}=25°C	-	191	-	A
			T_{vj}=125°C	-	219	-	
			T_{vj}=150°C	-		-	
t_{rr}	Reverse recovery time		T_{vj}=25°C	-	64	-	us
			T_{vj}=125°C	-	72	-	
			T_{vj}=150°C	-		-	

Q_r	Recovered charge		T_{vj}=25℃	-	24.7	-	μC
			T_{vj}=125℃	-	34.5	-	
			T_{vj}=150℃	-		-	
E_{rec}	Reverse recovery energy		T_{vj}=25℃	-	10.5	-	mJ
			T_{vj}=125℃	-	14.3	-	
			T_{vj}=150℃	-		-	
R_{thJC}	Thermal resistance,chip to case	per diode/ λgrease=2.8W/(m·K)		-		-	K/W
R_{thJH}	Thermalresistance, chip to heatsink			-		-	K/W
T_{vjop}	Temperature under switching conditions			-40		150	℃

Inner IGBT(Q2,Q3)

Maximum Rated Values

Symbol	Item	Conditions	Rating	Unit
V_{CES}	Collector-emitter voltage	T_{vj}=25℃	650	V
V_{GES}	Gate-emitter voltage	-	±20	V
I_C	Continuous Collector Current	T_C=80℃,T_{vj}=175℃	293	A
I_{CP}	Pulsed Collector Current	T_{vj}=175℃	880	A
T_{vj}	Junction Temperature	-	-40 to +175	℃

Characteristics Values

Symbol	Item	Conditions		Values			Unit
IGBT				Min.	Typ.	Max.	
I_{CES}	Collector-emitter cut-off current	V_{CE}=650V,V_{GE}=0V,T_{vj}=25℃		-	-	100	uA
I_{GES}	Gate leakage current	V_{CE}=0V,V_{GE}=20V,T_{vj}=25℃		-	-	100	nA
$V_{(BR)CES}$	Collector-emitter voltage	V_{GE}=0V, T_{vj}=25℃		650	-	-	V
$V_{GE(th)}$	Gate-emitter threshold voltage	I_C=8mA,V_{CE}=V_{GE},T_{vj}=25℃		3.5	4.04	6.4	V
V_{CEsat}	Collector-emitter saturation voltage	I_C=450A V_{GE}=15V	T_{vj}=25℃	-	1.26	3	
			T_{vj}=125℃	-	1.34	-	
			T_{vj}=150℃	-		-	
C_{ies}	Input capacitance	V_{CE}=20V,V_{GE}=0V f=10KHz,T_{vj}=25℃		-		-	nF
C_{oes}	Output capacitance			-		-	
C_{res}	Reverse transfer capacitance			-		-	
Q_G	Gate charge	V_{GE}=-8/+15V		-	0.89	-	uC

$t_{d(on)}$	Turn-on delay time	V_{CE}=400V, I_C=450A, V_{GE}=-8V/+15V, $R_{G(on)}$=20 Ω , $R_{G(off)}$=20 Ω	T_{vj}=25°C	-	227	-	us
			T_{vj}=125°C	-	206	-	
			T_{vj}=150°C	-		-	
t_r	Rise time		T_{vj}=25°C	-	194	-	
			T_{vj}=125°C	-	205	-	
			T_{vj}=150°C	-		-	
$t_{d(off)}$	Turn-off delay time		T_{vj}=25°C	-	1552	-	
			T_{vj}=125°C	-	1608	-	
			T_{vj}=150°C	-		-	
t_f	Fall time		T_{vj}=25°C	-	166	-	
			T_{vj}=125°C	-	173	-	
			T_{vj}=150°C	-		-	
E_{on}	Turn-on energy (per pulse)	V_{CE}=400V, I_C=450A, V_{GE}=-8V/+15V, $R_{G(on)}$=20 Ω , $R_{G(off)}$=20 Ω	T_{vj}=25°C	-	14.2	-	mJ
			T_{vj}=125°C	-	17.9	-	
			T_{vj}=150°C	-		-	
E_{off}	Turn-off energy (per pulse)		T_{vj}=25°C	-	45.6	-	
			T_{vj}=125°C	-	49.3	-	
			T_{vj}=150°C	-		-	
SC data	Short-circuit current	V_{CC}=400V,V_{GE}≤15V,T_{vj}=150°C, t_P≤10μs		-	-	-	A
R_{thJC}	Thermal resistance,chip to case	per IGBT/ λgrease=2.8W/(m·K)		-		-	K/W
R_{thJH}	Thermalresistance, chip to heatsink			-		-	K/W

Inverse Diode(D1,D2, D3,D4)

Maximum Rated Values

Symbol	Item	Conditions	Rating	Unit
V_{RRM}	Repetitive peak reverse voltage	T_{vj}=25°C	650	V
I_F	Forward current,DC	T_C=80°C,T_{vj}=175°C	188	A
I_{FRM}	Repetitive peak forward current	T_{vj}=175°C	563	A
I^2t	I^2t-value	V_R=0V, t_p =10ms, T_{vj} =125°C	1800	A^2s
T_{vj}	Junction Temperature	-	-40 to +175	°C

Characteristic Values

				Min.	Typ.	Max.	
V_F	Continuous forward voltage	I_F=450A V_{GE}=0V	T_{vj}=25°C	-	1.73	3	V
			T_{vj}=125°C	-	1.94	-	
			T_{vj}=150°C	-		-	
I_{RM}	Peak reverse recovery current	V_{CE}=400V, I_C=450A, V_{GE}=-8V/+15V, $R_{G(on)}$=20 Ω , $R_{G(off)}$=20 Ω	T_{vj}=25°C	-	105	-	A
			T_{vj}=125°C	-	123	-	
			T_{vj}=150°C	-		-	
t_{rr}	Reverse recovery time		T_{vj}=25°C	-	52	-	us
			T_{vj}=125°C	-	56	-	
			T_{vj}=150°C	-		-	

Q_r	Recovered charge		T_{vj}=25℃	-	10.8	-	μC
			T_{vj}=125℃	-	16.6	-	
			T_{vj}=150℃	-		-	
E_{rec}	Reverse recovery energy		T_{vj}=25℃	-	5.5	-	mJ
			T_{vj}=125℃	-	6.7	-	
			T_{vj}=150℃	-		-	
R_{thJC}	Thermal resistance,chip to case	per diode/ λgrease=2.8W/(m·K)		-		-	K/W
R_{thJH}	Thermalresistance, chip to heatsink			-		-	K/W
T_{vjop}	Temperature under switching conditions			-40		150	℃

NTC Thermistor Characteristics

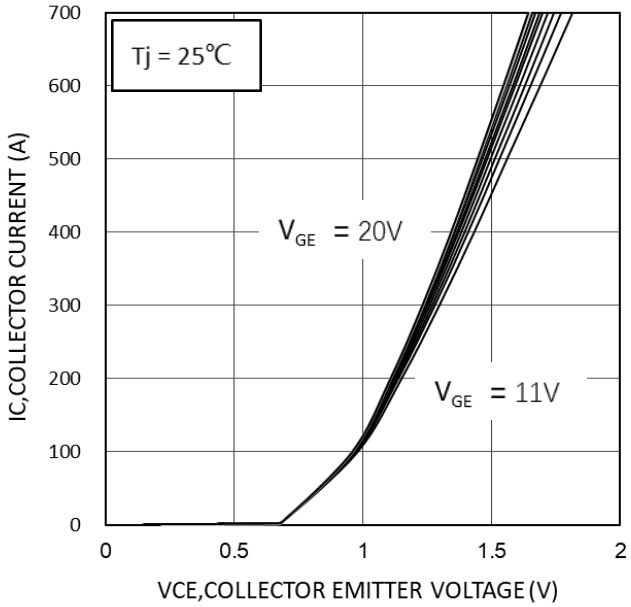
Symbol	Item	Conditions	Values			Unit
			Min.	Typ.	Max.	
R_{25}	Rated resistance	T_C=25℃	-	22	-	kΩ
ΔR/R	Deviation of resistance	T_C=100℃,R_{100}=1486Ω	-5	-	5	%
P_{25}	Power dissipation	T_C=25℃	-	-	20	mW
$B_{25/50}$	B-constant	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15K))$	-	3950	-	K
$B_{25/80}$	B-constant	$R_2=R_{25}\exp[B_{25/80}(1/T_2-1/(298.15K))$	-	-	-	
$B_{25/100}$	B-constant	$R_2=R_{25}\exp[B_{25/100}(1/T_2-1/(298.15K))$	-	3998	-	

Module

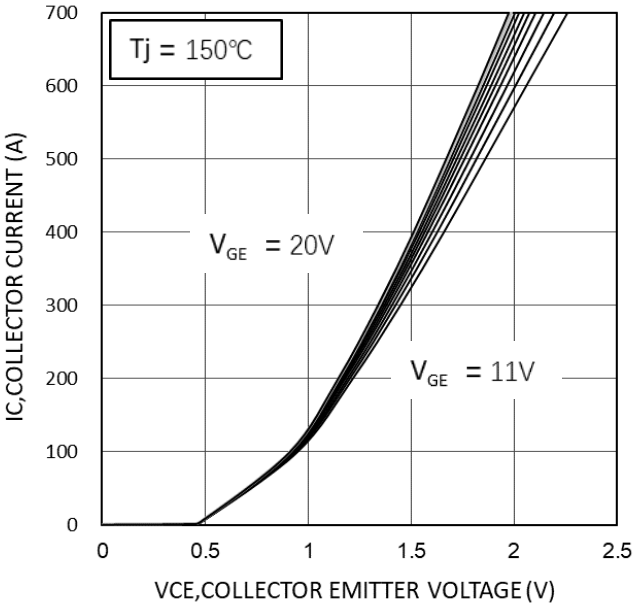
Symbol	Item	Conditions	Rating			Unit
V_{ISOL}	Isolation voltage	Terminals to baseplate，RMS,f=50Hz,t=1min	4000			V
-	Material of module baseplate	-	Cu			-
T_{stg}	Storage temperature	-	-40~125			℃
T_{op}	Operating temperature	-	-40~150			℃
Symbol	Item	Conditions	Values			Unit
			Min.	Typ.	Max.	-
M	Mounting torque for module mounting	Screw M5	3.0	-	5.0	Nm
L_{sCE}	Stray inductance module	-				nH
d_{Creep}	Creepage distance	Terminal to terminal	-	13	-	mm
		Terminal to base plate	-	14.5	-	
d_{Clear}	Clearance	Terminal to terminal	-	10	-	mm
		Terminal to base plate	-	12.5	-	
CTI	Comperative tracking index	-		⩾600		
RTI	-	-		130		℃
Bd	Baseplate deflection	-			0.3	mm
m	Weight	-	-	176.5	-	g

Typical Characteristics
IGBT Q1, Q4 And Diode D1, D4

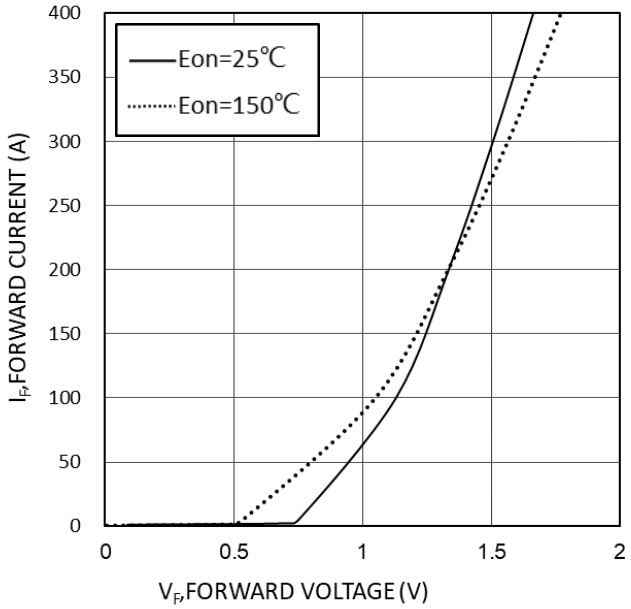
Typical Output Characteristics(25℃)



Typical Output Characteristics(125℃)

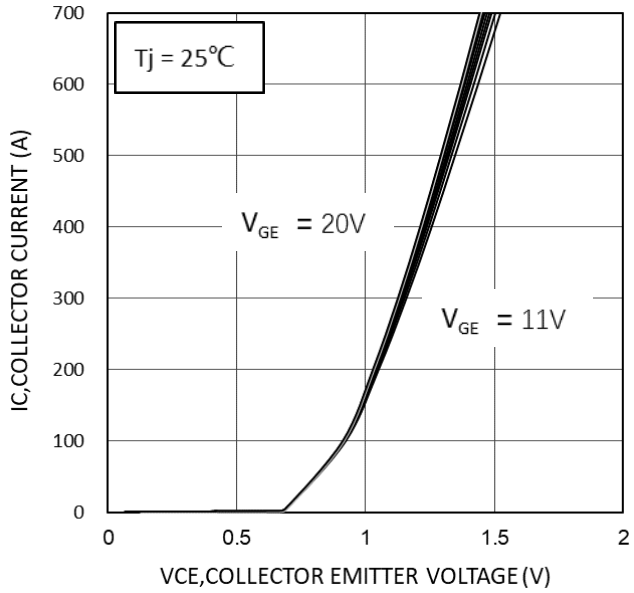


Body Diode Characteristics

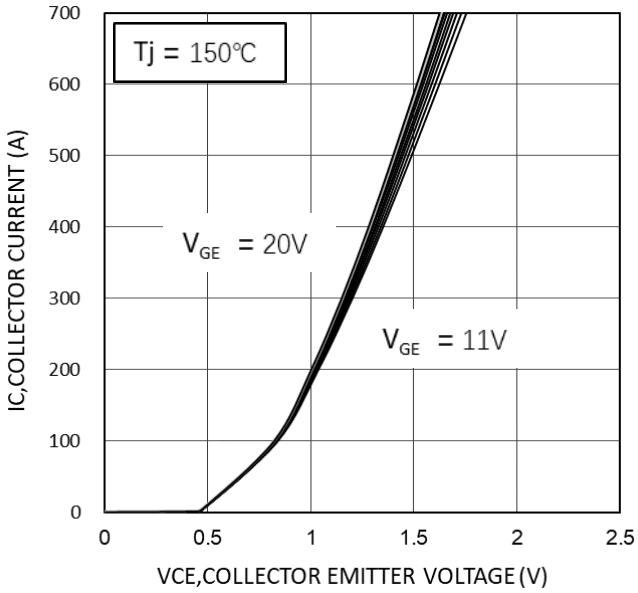


Typical Characteristics
IGBT Q2, Q3 And Diode D2, D3

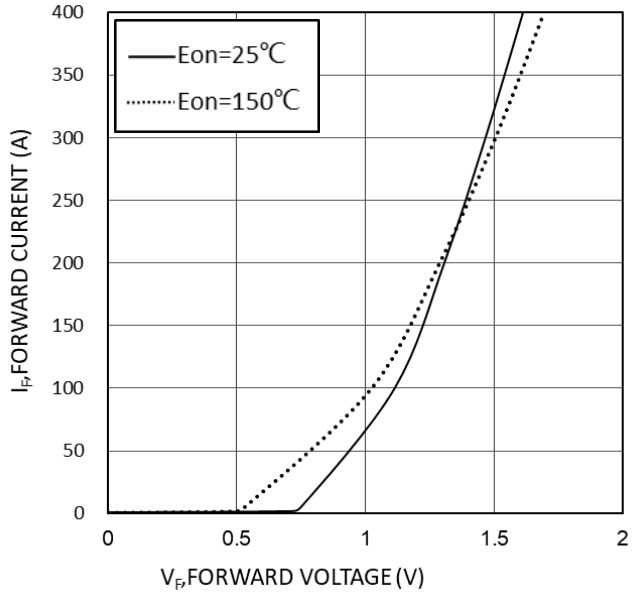
Typical Output Characteristics(25℃)



Typical Output Characteristics(125℃)

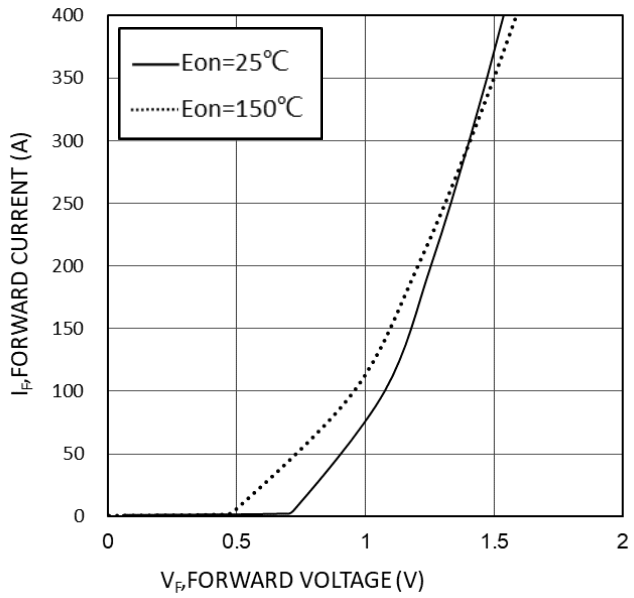


Body Diode Characteristics



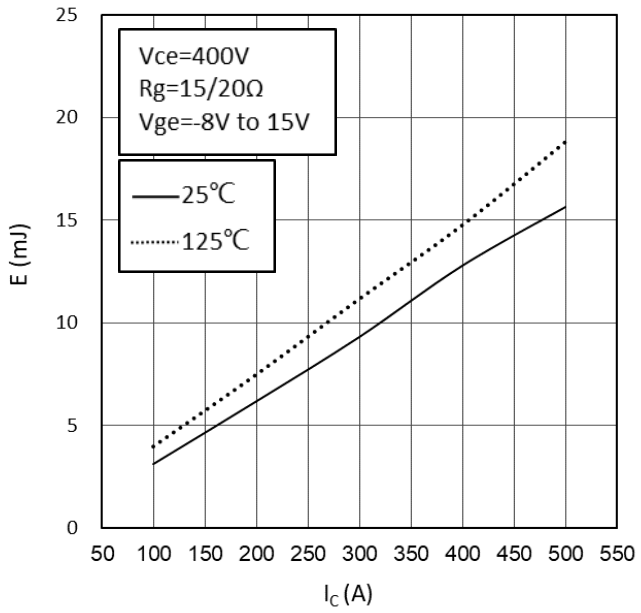
Typical Characteristics
Diode D5, D6

Diode Forward Characteristice

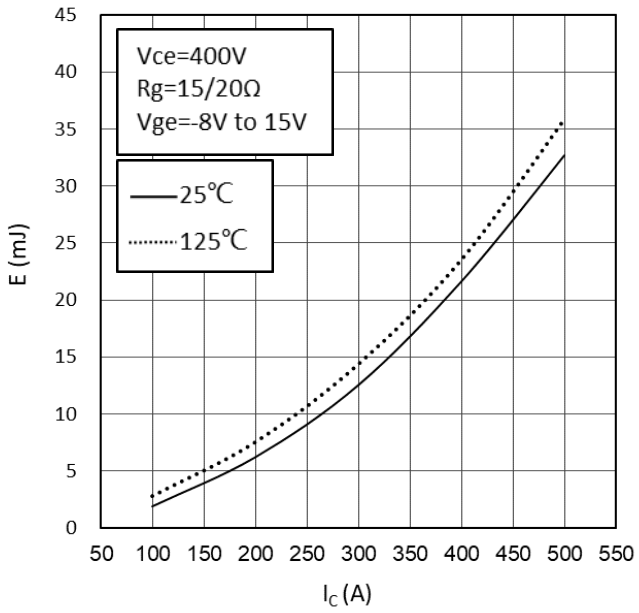


Typical Characteristics
IGBT Q1, Q4 And Diode D5, D6

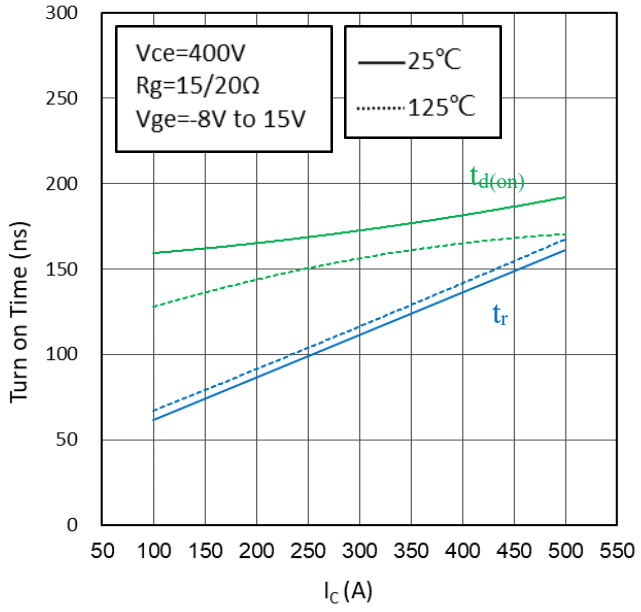
Typical Switching Loss Eon vs. IC



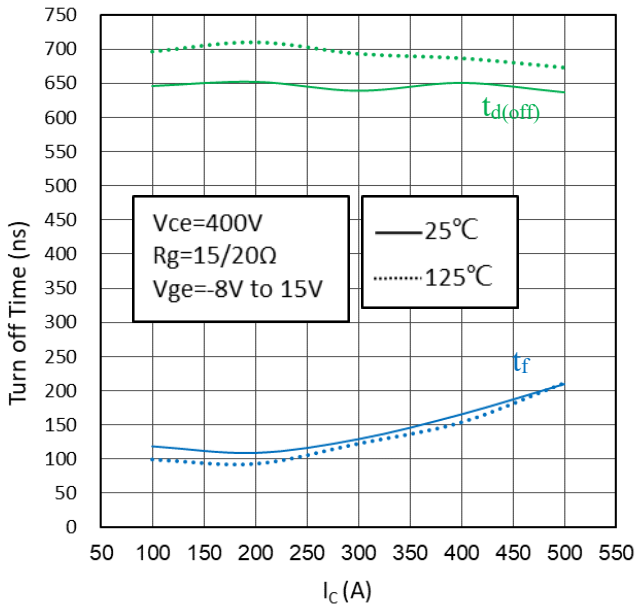
Typical Switching Loss Eoff vs. IC



Typical Switching Time Ton vs. IC

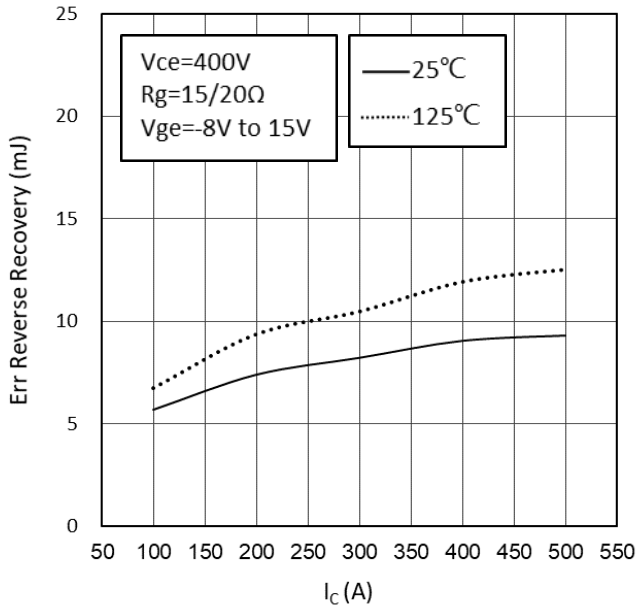


Typical Switching Time Toff vs. IC

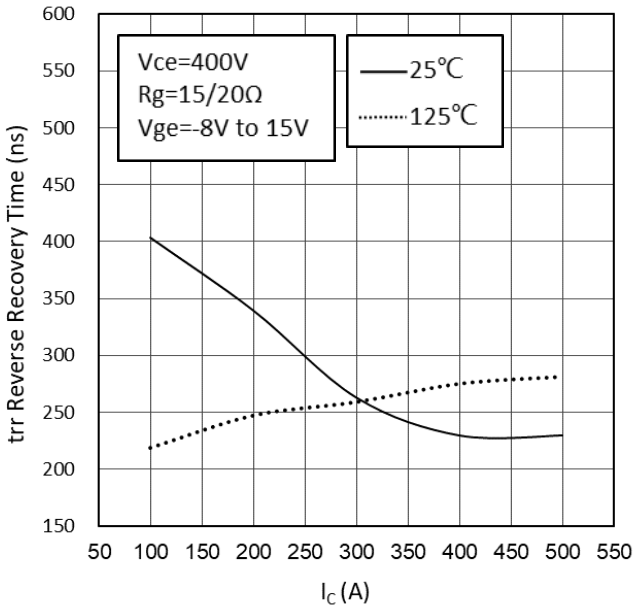


Typical Characteristics
IGBT Q1, Q4 And Diode D5, D6

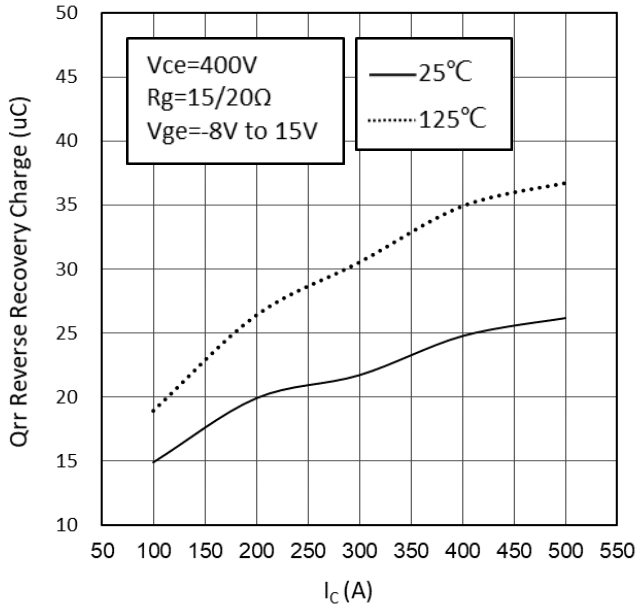
Typical Reverse Recovery Energy vs. IC



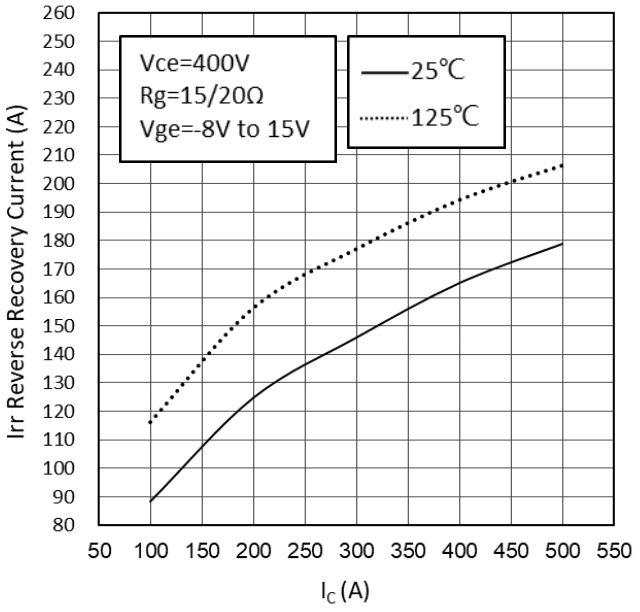
Typical Reverse Recovery Time vs. IC



Typical Reverse Recovery Charge vs. IC

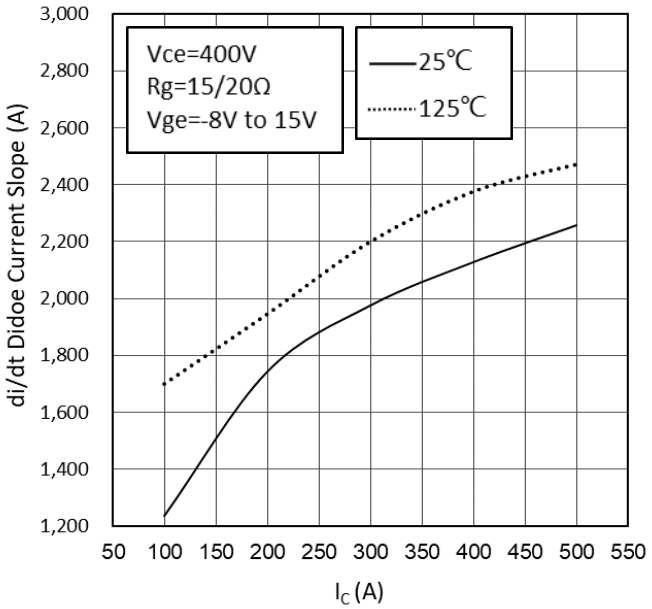


Typical Reverse Recovery Current vs. IC



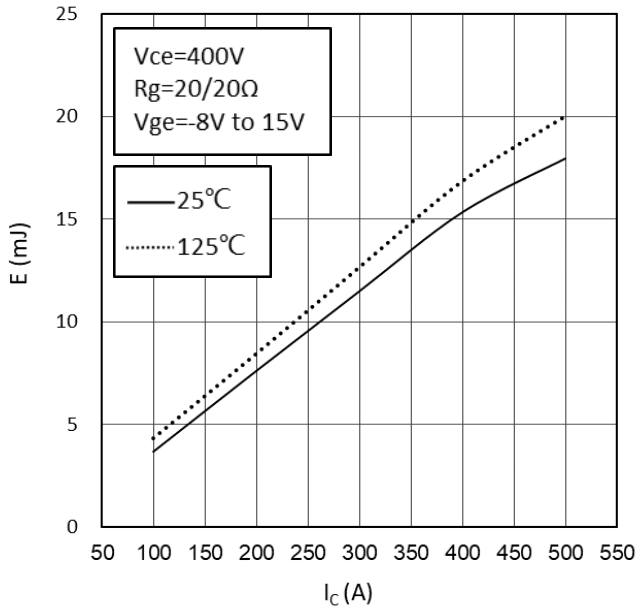
Typical Characteristics
IGBT Q1, Q4 And Diode D5, D6

Typical di/dt vs. IC

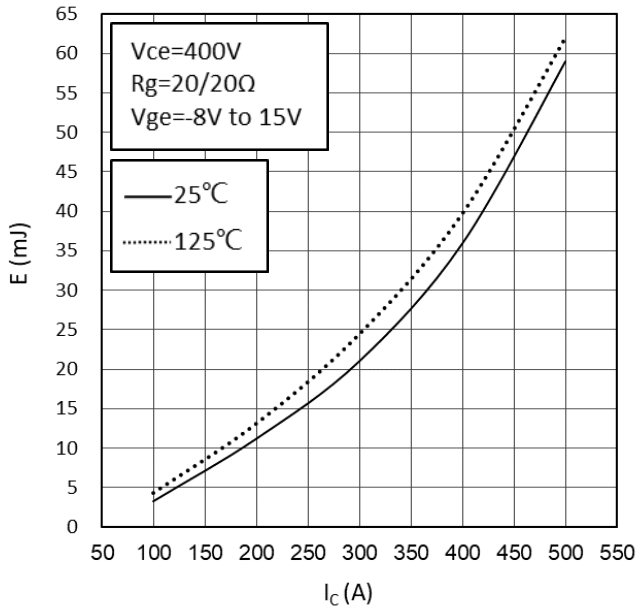


Typical Characteristics
IGBT Q2, Q3 And Diode D1, D4

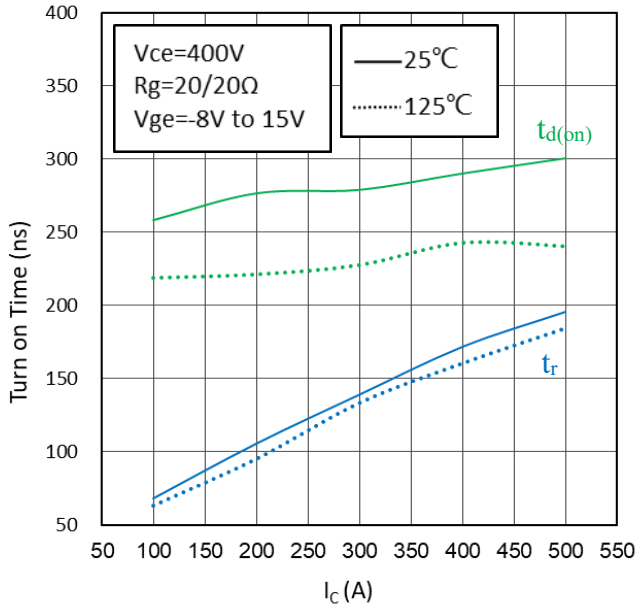
Typical Switching Loss Eon vs. IC



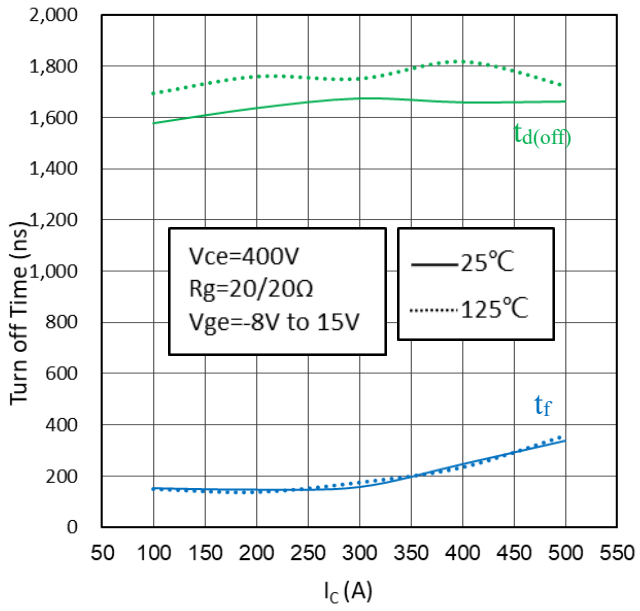
Typical Switching Loss Eoff vs. IC



Typical Switching Time Ton vs. IC

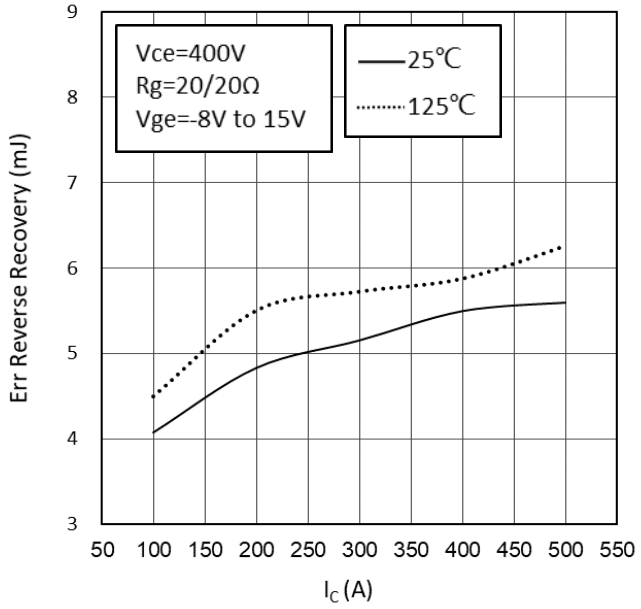


Typical Switching Time Toff vs. IC

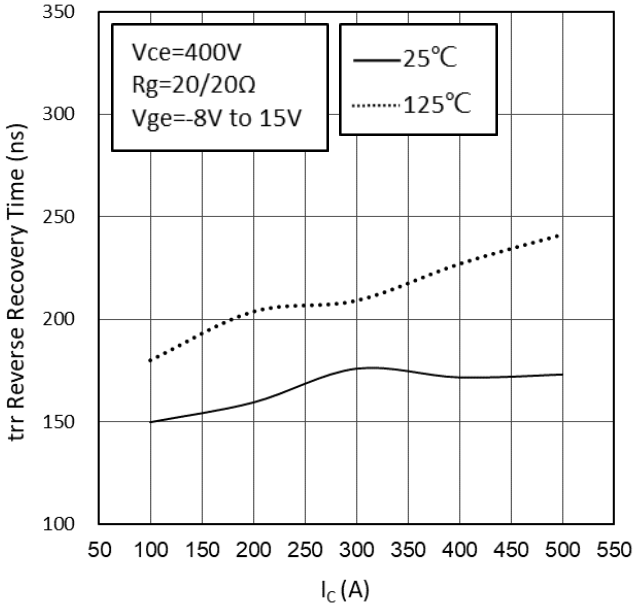


Typical Characteristics
IGBT Q2, Q3 And Diode D1, D4

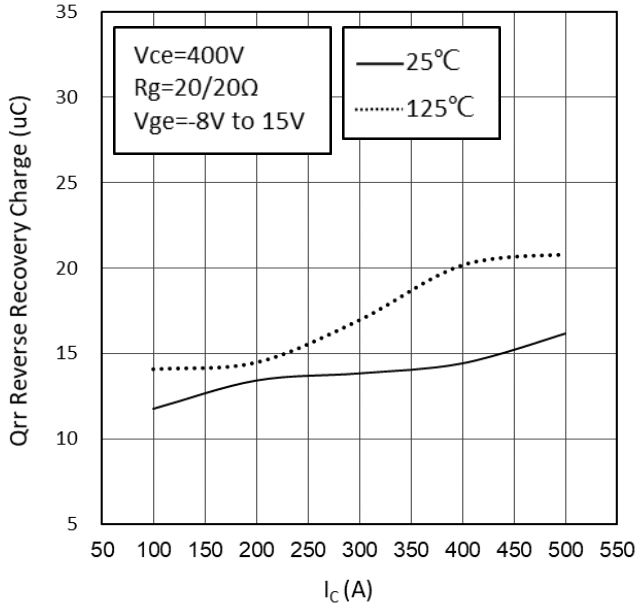
Typical Reverse Recovery Energy vs. IC



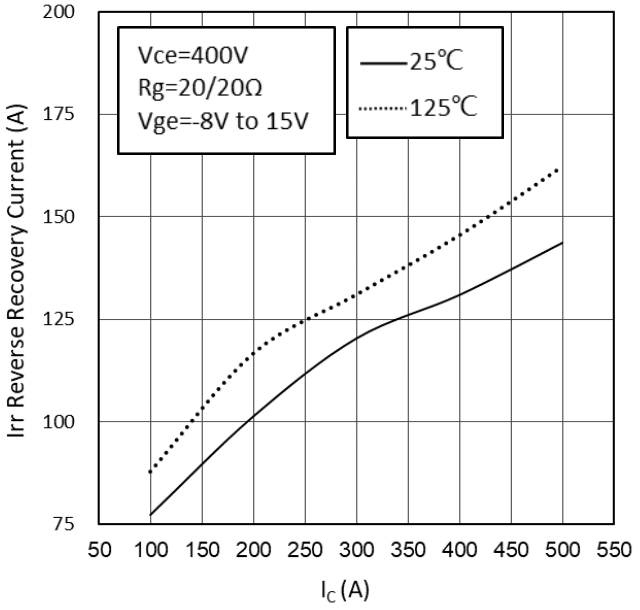
Typical Reverse Recovery Time vs. IC



Typical Reverse Recovery Charge vs. IC

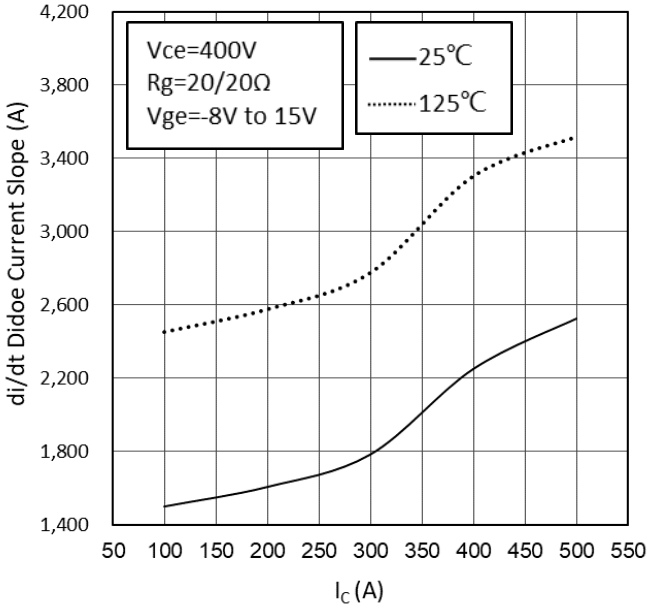


Typical Reverse Recovery Current vs. IC

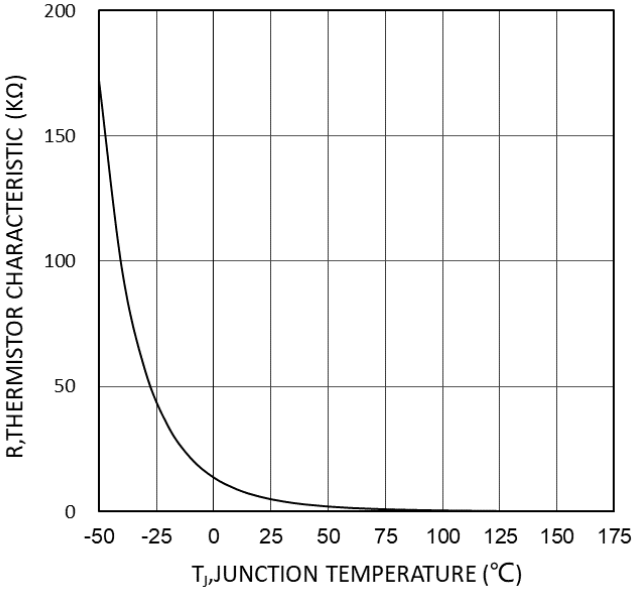


Typical Characteristics
IGBT Q2, Q3 And Diode D1, D4

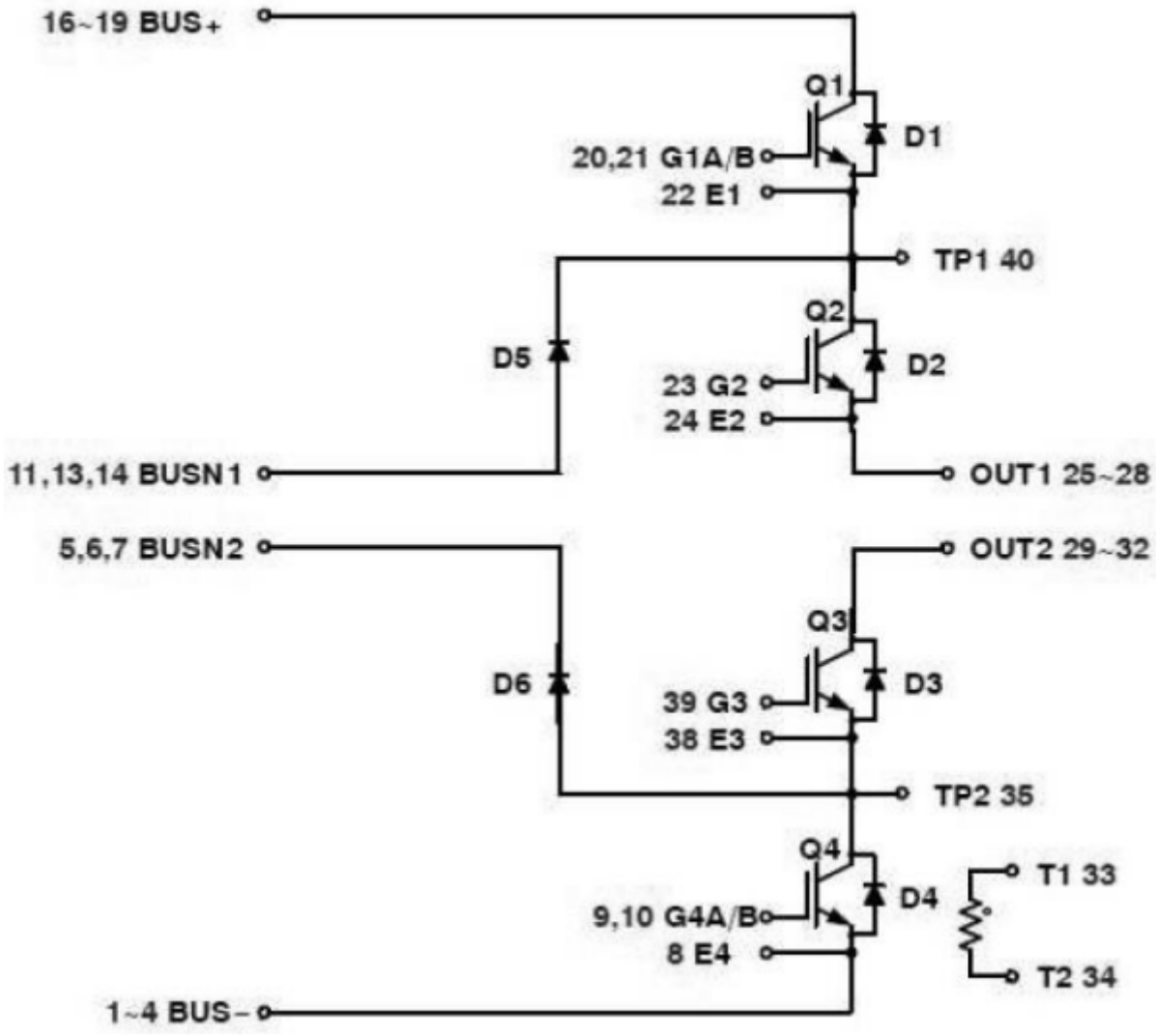
Typical di/dt vs. IC



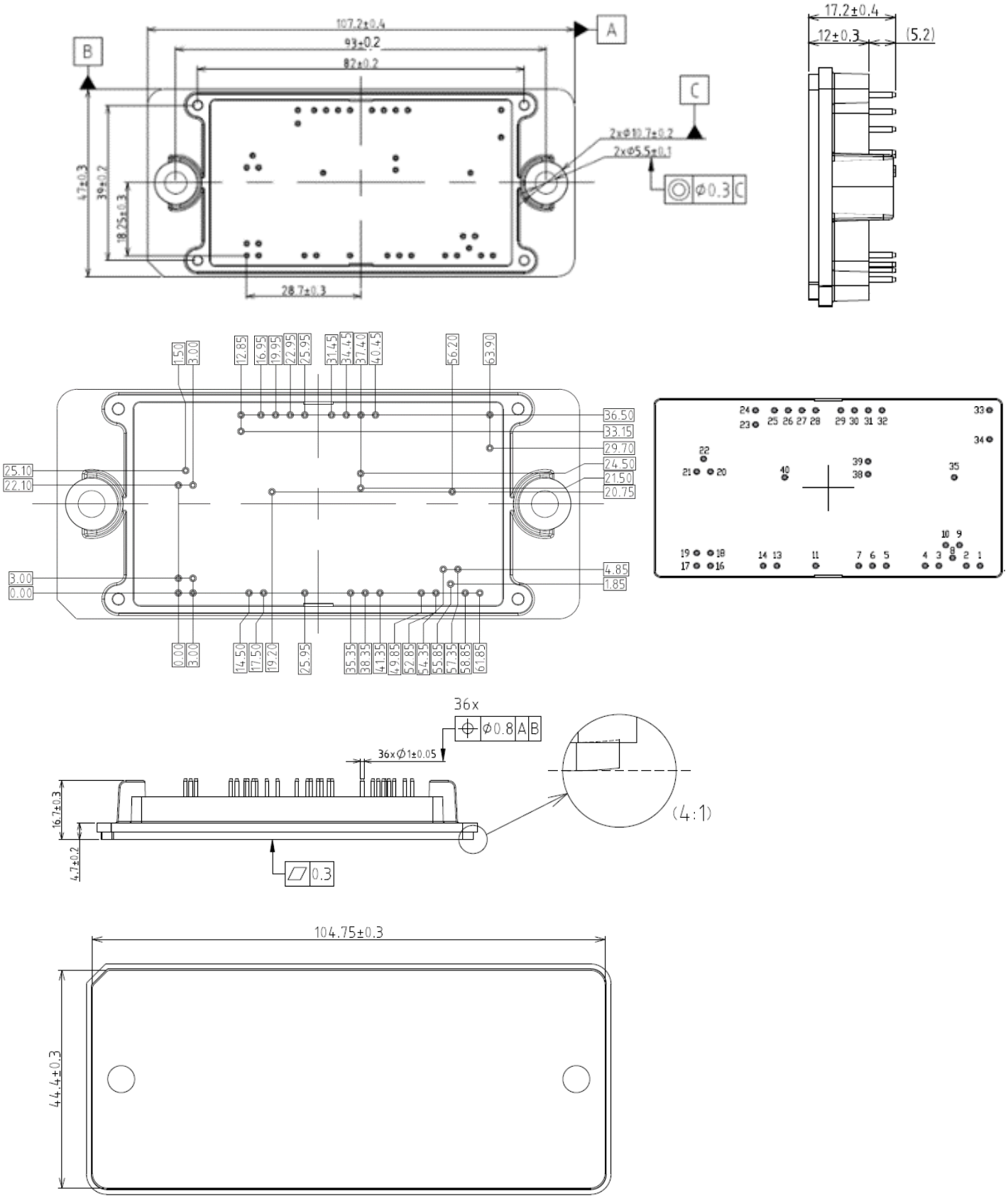
Typical Reverse Recovery Time vs. IC



Circuit diagram headline



Package outlines (Unit: mm)



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序号 Item	日期 Date	变更记录及描述 Change History Description	版本序号 Rev. item	经办人 Responsibility
1	2023.8.17	初版规格书发布，版本为V1.0	2023 8 Ver1.0	梁华文
2	2323.9.20	更新曲线图。	2023 9 Ver1.1	梁华文