

PRODUCT FEATURES

- Mixed voltage component topology
- Neutral point clamped inverter
- Reactive power capability
- Low inductance layout



APPLICATIONS

- Solar inverter
- UPS

Type	V _{CES}	I _C	T _{Jmax}	Marking	Package
MMG80C120BF6TC_Y1	1200V	80A	175°C	MMG80C120BF6TC_Y1	GC

Half Bridge IGBT(T1 T2)

ABSOLUTE MAXIMUM RATINGS(*T_C = 25°C unless otherwise specified*)

Symbol	Parameter/Test Conditions		Values	Unit
V _{CES}	Collector Emitter Voltage	T _J =25°C	1200	V
V _{GES}	Gate Emitter Voltage		±20	
I _{CN}	Implemented Collector Current		80	A
I _C	Continuous DC Collector Current	T _C =80°C, T _{Jmax} =175°C	88	
I _{CM}	Repetitive Peak Collector Current	tp=1ms	160	
P _{tot}	Power Dissipation Per IGBT	T _C =25°C, T _{Jmax} =175°C	600	W

Half Bridge Diode(D1 D2)

ABSOLUTE MAXIMUM RATINGS (*T_C = 25°C unless otherwise specified*)

Symbol	Parameter/Test Conditions		Values	Unit
V _{RRM}	Repetitive Reverse Voltage	T _J =25°C	1200	V
I _{FN}	Implemented Forward Current		50	A
I _F	Continuous DC Forward Current		30	
I _{FRM}	Repetitive Peak Forward Current	tp=1ms	100	
I ² t		T _J =125°C, t=10ms, V _R =0V	310	A ² s

MMG80C120BF6TC_Y1

Half Bridge IGBT(T1 T2)

ELECTRICAL CHARACTERISTICS ($T_C=25^{\circ}\text{C}$ unless otherwise specified)

Symbol	Parameter/Test Conditions		Min.	Typ.	Max.	Unit
$V_{GE(th)}$	Gate Emitter Threshold Voltage	$V_{CE}=V_{GE}, I_C=3.2\text{mA}$	5.0	6.0	6.5	V
$V_{CE(sat)}$	Collector Emitter Saturation Voltage (chip)	$I_C=80\text{A}, V_{GE}=15\text{V}, T_J=25^{\circ}\text{C}$		1.95	2.35	
		$I_C=80\text{A}, V_{GE}=15\text{V}, T_J=150^{\circ}\text{C}$		2.4		
		$I_C=30\text{A}, V_{GE}=15\text{V}, T_J=25^{\circ}\text{C}$		1.4	1.69	
		$I_C=30\text{A}, V_{GE}=15\text{V}, T_J=150^{\circ}\text{C}$		1.52		
I_{CES}	Collector Leakage Current	$V_{CE}=1200\text{V}, V_{GE}=0\text{V}, T_J=25^{\circ}\text{C}$			1	mA
		$V_{CE}=1200\text{V}, V_{GE}=0\text{V}, T_J=150^{\circ}\text{C}$			10	mA
I_{GES}	Gate Leakage Current	$V_{CE}=0\text{V}, V_{GE}=\pm 20\text{V}, T_J=25^{\circ}\text{C}$	-400		400	nA
R_{Gint}	Integrated Gate Resistor			0		Ω
Q_G	Gate Charge	$V_{CE}=600\text{V}, I_C=80\text{A}, V_{GE}=15\text{V}$		0.38		μC
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, V_{GE}=0\text{V}, f=1\text{MHz}$		5		nF
C_{res}	Reverse Transfer Capacitance				220	
$t_{d(on)}$	Turn on Delay Time	$V_{CC}=400\text{V}, I_C=30\text{A}$ $R_G=7.5\Omega,$ $V_{GE}=\pm 15\text{V},$ Inductive Load	$T_J=25^{\circ}\text{C}$		10	ns
			$T_J=150^{\circ}\text{C}$		8	ns
t_r	Rise Time	$V_{GE}=\pm 15\text{V},$ Inductive Load	$T_J=25^{\circ}\text{C}$		14	ns
			$T_J=150^{\circ}\text{C}$		16	ns
$t_{d(off)}$	Turn off Delay Time	$V_{CC}=400\text{V}, I_C=30\text{A}$ $R_G=7.5\Omega,$ $V_{GE}=\pm 15\text{V},$ Inductive Load	$T_J=25^{\circ}\text{C}$		220	ns
			$T_J=150^{\circ}\text{C}$		270	ns
t_f	Fall Time	$V_{GE}=\pm 15\text{V},$ Inductive Load	$T_J=25^{\circ}\text{C}$		120	ns
			$T_J=150^{\circ}\text{C}$		260	ns
E_{on}	Turn on Energy	$V_{CC}=400\text{V}, I_C=30\text{A}$ $R_G=7.5\Omega,$ $V_{GE}=\pm 15\text{V},$ Inductive Load	$T_J=25^{\circ}\text{C}$		0.45	mJ
			$T_J=150^{\circ}\text{C}$		0.8	mJ
E_{off}	Turn off Energy	$V_{GE}=\pm 15\text{V},$ Inductive Load	$T_J=25^{\circ}\text{C}$		0.95	mJ
			$T_J=150^{\circ}\text{C}$		1.5	mJ
I_{SC}	Short Circuit Current	$tpsc \leq 10\mu\text{s}, V_{GE}=15\text{V}$ $T_J=125^{\circ}\text{C}, V_{CC}=600\text{V}$		520		A
R_{thJC}	Junction to Case Thermal Resistance (Per IGBT)				0.25	K/W

Half Bridge Diode(D1 D2)

ELECTRICAL CHARACTERISTICS ($T_C=25^{\circ}\text{C}$ unless otherwise specified)

Symbol	Parameter/Test Conditions		Min.	Typ.	Max.	Unit
V_F	Forward Voltage (chip)	$I_F=50\text{A}, V_{GE}=0\text{V}, T_J=25^{\circ}\text{C}$		1.8	2.3	V
		$I_F=50\text{A}, V_{GE}=0\text{V}, T_J=150^{\circ}\text{C}$		1.5		
		$I_F=30\text{A}, V_{GE}=0\text{V}, T_J=25^{\circ}\text{C}$		1.62		
		$I_F=30\text{A}, V_{GE}=0\text{V}, T_J=150^{\circ}\text{C}$		1.28		
t_{rr}	Reverse Recovery Time	$I_F=30\text{A}, V_R=400\text{V}$ $dI_F/dt=-1600\text{A}/\mu\text{s}$ $T_J=150^{\circ}\text{C}$		140		ns
I_{RRM}	Max. Reverse Recovery Current			78		A
Q_{RR}	Reverse Recovery Charge			8.8		μC
E_{rec}	Reverse Recovery Energy			2.3		mJ
R_{thJCD}	Junction to Case Thermal Resistance (Per Diode)				0.8	K/W

MMG80C120BF6TC_Y1

Neutral Point IGBT(T3 T4)

ABSOLUTE MAXIMUM RATINGS($T_C=25^{\circ}\text{C}$ unless otherwise specified)

Symbol	Parameter/Test Conditions		Values	Unit
V_{CES}	Collector Emitter Voltage	$T_J=25^{\circ}\text{C}$	650	V
V_{GES}	Gate Emitter Voltage		± 20	
I_{CN}	Implemented Collector Current		75	A
I_C	Continuous DC Collector Current	$T_C=80^{\circ}\text{C}, T_{Jmax}=175^{\circ}\text{C}$	68	
I_{CM}	Repetitive Peak Collector Current	$tp=1\text{ms}$	150	
P_{tot}	Power Dissipation Per IGBT	$T_C=25^{\circ}\text{C}, T_{Jmax}=175^{\circ}\text{C}$	319	W

Neutral Point IGBT(T3 T4)

ELECTRICAL CHARACTERISTICS ($T_C=25^{\circ}\text{C}$ unless otherwise specified)

Symbol	Parameter/Test Conditions		Min.	Typ.	Max.	Unit
$V_{GE(th)}$	Gate Emitter Threshold Voltage	$V_{CE}=V_{GE}, I_C=3.0\text{mA}$	4.8	5.6	6.5	V
$V_{CE(sat)}$	Collector Emitter Saturation Voltage (chip)	$I_C=75\text{A}, V_{GE}=15\text{V}, T_J=25^{\circ}\text{C}$		1.5	1.85	
		$I_C=75\text{A}, V_{GE}=15\text{V}, T_J=150^{\circ}\text{C}$		1.85		
		$I_C=30\text{A}, V_{GE}=15\text{V}, T_J=25^{\circ}\text{C}$		1.13		
		$I_C=30\text{A}, V_{GE}=15\text{V}, T_J=150^{\circ}\text{C}$		1.23		
I_{CES}	Collector Leakage Current	$V_{CE}=650\text{V}, V_{GE}=0\text{V}, T_J=25^{\circ}\text{C}$			1	mA
		$V_{CE}=650\text{V}, V_{GE}=0\text{V}, T_J=150^{\circ}\text{C}$			5	mA
I_{GES}	Gate Leakage Current	$V_{CE}=0\text{V}, V_{GE}=\pm 20\text{V}, T_J=25^{\circ}\text{C}$	-200		200	nA
R_{Gint}	Integrated Gate Resistor			0		Ω
Q_G	Gate Charge	$V_{CE}=300\text{V}, I_C=75\text{A}, V_{GE}=15\text{V}$		0.36		μC
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, V_{GE}=0\text{V}, f=1\text{MHz}$		4.8		nF
C_{res}	Reverse Transfer Capacitance				208	
$t_{d(on)}$	Turn on Delay Time	$V_{CC}=400\text{V}, I_C=30\text{A}$ $R_G=7.5\Omega,$	$T_J=25^{\circ}\text{C}$	8		ns
			$T_J=150^{\circ}\text{C}$	8		ns
t_r	Rise Time	$V_{GE}=\pm 15\text{V},$ Inductive Load	$T_J=25^{\circ}\text{C}$	14		ns
			$T_J=150^{\circ}\text{C}$	14		ns
$t_{d(off)}$	Turn off Delay Time	$V_{CC}=400\text{V}, I_C=30\text{A}$ $R_G=7.5\Omega,$	$T_J=25^{\circ}\text{C}$	200		ns
			$T_J=150^{\circ}\text{C}$	220		ns
t_f	Fall Time	$V_{GE}=\pm 15\text{V},$ Inductive Load	$T_J=25^{\circ}\text{C}$	160		ns
			$T_J=150^{\circ}\text{C}$	210		ns
E_{on}	Turn on Energy	$V_{CC}=400\text{V}, I_C=30\text{A}$ $R_G=7.5\Omega,$	$T_J=25^{\circ}\text{C}$	0.6		mJ
			$T_J=150^{\circ}\text{C}$	0.9		mJ
E_{off}	Turn off Energy	$V_{GE}=\pm 15\text{V},$ Inductive Load	$T_J=25^{\circ}\text{C}$	1.15		mJ
			$T_J=150^{\circ}\text{C}$	1.7		mJ
I_{SC}	Short Circuit Current	$tpsc \leq 6\mu\text{s}, V_{GE}=15\text{V}$ $T_J=125^{\circ}\text{C}, V_{CC}=360\text{V}$		400		A
R_{thJC}	Junction to Case Thermal Resistance (Per IGBT)				0.47	K/W

MMG80C120BF6TC_Y1

Neutral Point Diode(D3 D4)

ABSOLUTE MAXIMUM RATINGS ($T_C = 25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter/Test Conditions		Values	Unit
V_{RRM}	Repetitive Reverse Voltage	$T_J = 25^\circ\text{C}$	650	V
I_{FN}	Implemented Forward Current		75	A
I_F	Continuous DC Forward Current		30	
I_{FRM}	Repetitive Peak Forward Current	$t_p = 1\text{ms}$	150	
I^2t		$T_J = 125^\circ\text{C}$, $t = 10\text{ms}$, $V_R = 0\text{V}$	310	A^2s

Neutral Point Diode(D3 D4)

ELECTRICAL CHARACTERISTICS ($T_C = 25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter/Test Conditions		Min.	Typ.	Max.	Unit
V_F	Forward Voltage (chip)	$I_F = 75\text{A}$, $V_{GE} = 0\text{V}$, $T_J = 25^\circ\text{C}$		1.7	2.15	V
		$I_F = 75\text{A}$, $V_{GE} = 0\text{V}$, $T_J = 150^\circ\text{C}$		1.45		
		$I_F = 30\text{A}$, $V_{GE} = 0\text{V}$, $T_J = 25^\circ\text{C}$		1.42		
		$I_F = 30\text{A}$, $V_{GE} = 0\text{V}$, $T_J = 150^\circ\text{C}$		1.1		
t_{rr}	Reverse Recovery Time	$I_F = 30\text{A}$, $V_R = 400\text{V}$ $dI_F/dt = -1500\text{A}/\mu\text{s}$ $T_J = 150^\circ\text{C}$		110		ns
I_{RRM}	Max. Reverse Recovery Current			55		A
Q_{RR}	Reverse Recovery Charge			3.1		μC
E_{rec}	Reverse Recovery Energy			1		mJ
R_{thJCD}	Junction to Case Thermal Resistance (Per Diode)				1.0	K/W

NTC CHARACTERISTICS ($T_C = 25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter/Test Conditions		Min.	Typ.	Max.	Unit
R_{25}	Resistance	$T_C = 25^\circ\text{C}$		22		$\text{K}\Omega$
$B_{25/50}$	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298.15\text{K}))]$			3950		K

MODULE CHARACTERISTICS ($T_C=25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter/Test Conditions		Values	Unit
T_{Jmax}	Max. Junction Temperature		175	°C
T_{Jop}	Operating Temperature		-40~150	
T_{stg}	Storage Temperature		-40~125	
V_{isol}	Isolation Breakdown Voltage	AC, 50Hz(R.M.S), t=1minute	3000	V
Torque	to heatsink	Recommended (M4)	0.7~1.1	Nm
Weight			30	g

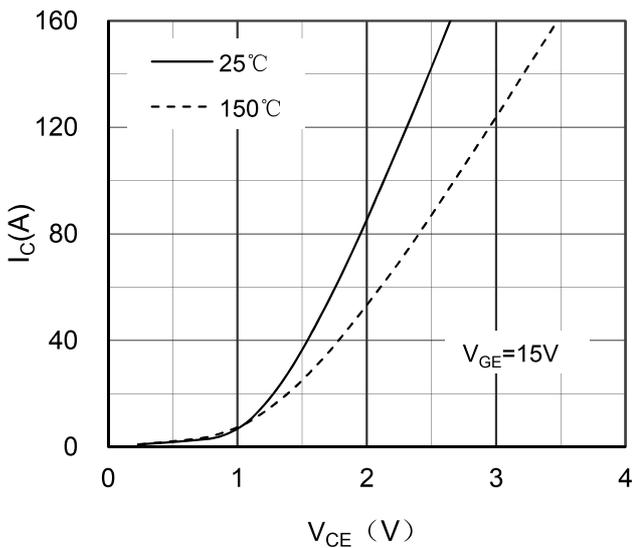


Figure 1. Typical Output Characteristics Half Bridge IGBT

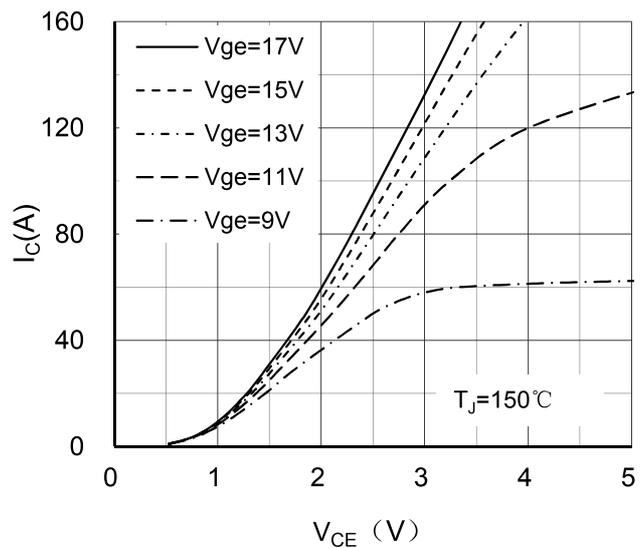


Figure 2. Typical Output Characteristics Half Bridge IGBT

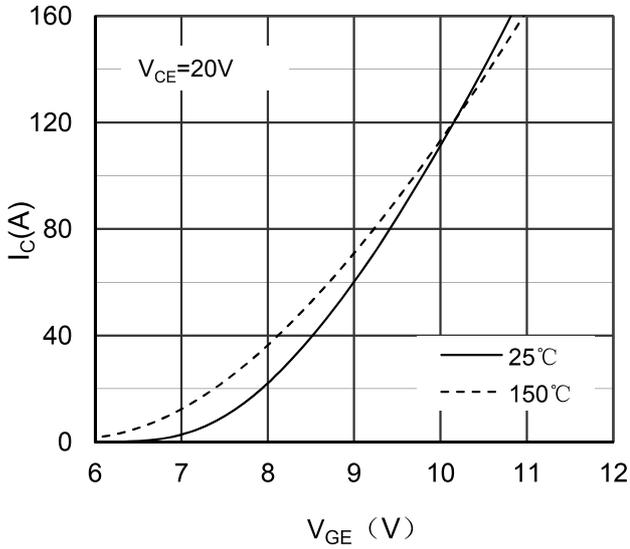


Figure 3. Typical Transfer characteristics Half Bridge IGBT

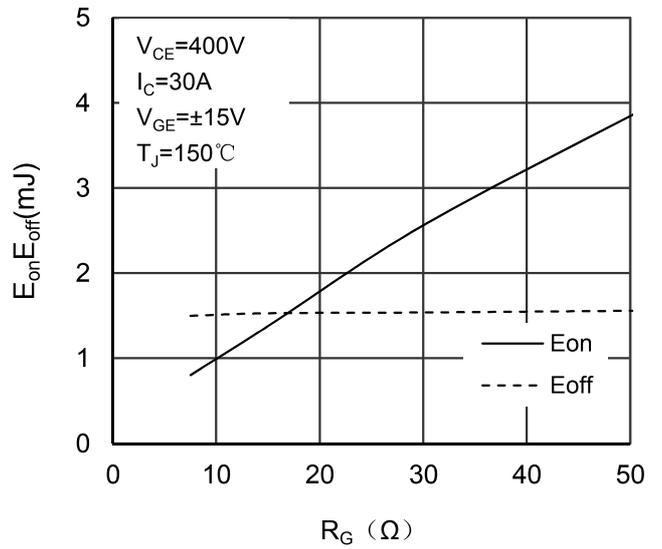


Figure 4. Switching Energy vs Gate Resistor Half Bridge IGBT

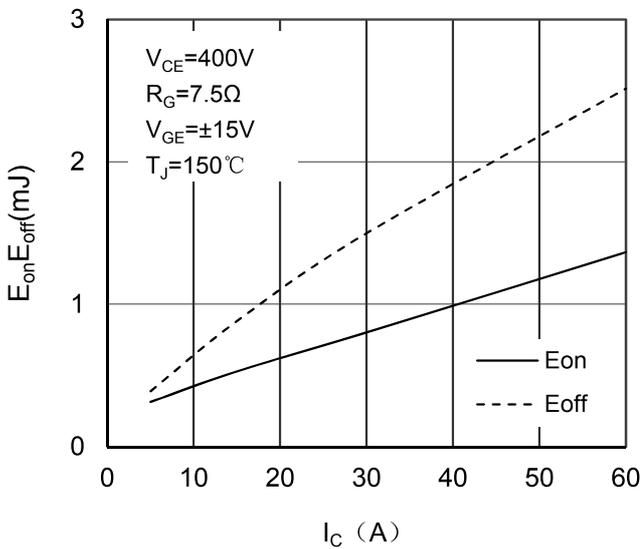


Figure 5. Switching Energy vs Collector Current Half Bridge IGBT

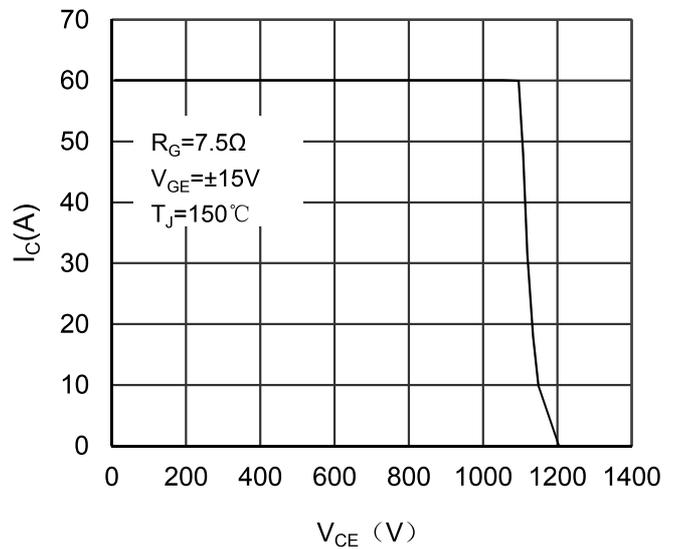


Figure 6. Reverse Biased Safe Operating Area Half Bridge IGBT

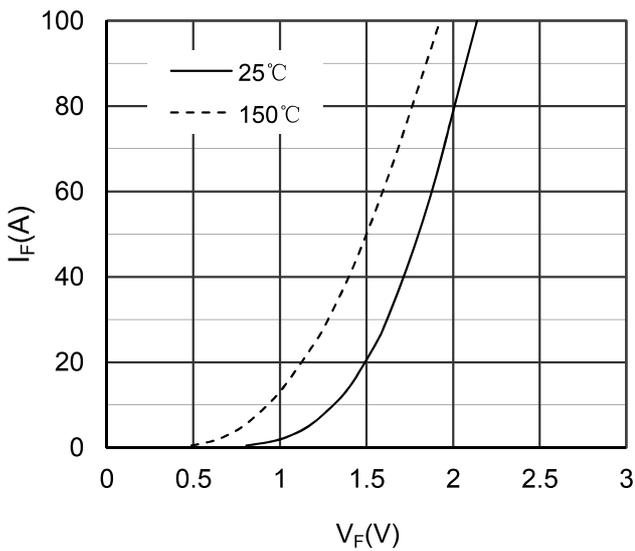


Figure 7. Diode Forward Characteristics Half Bridge Diode

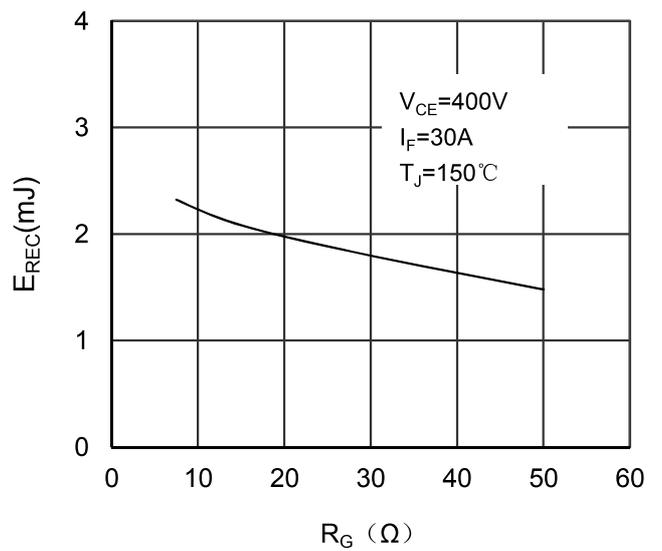


Figure 8. Switching Energy vs Gate Resistor Half Bridge Diode

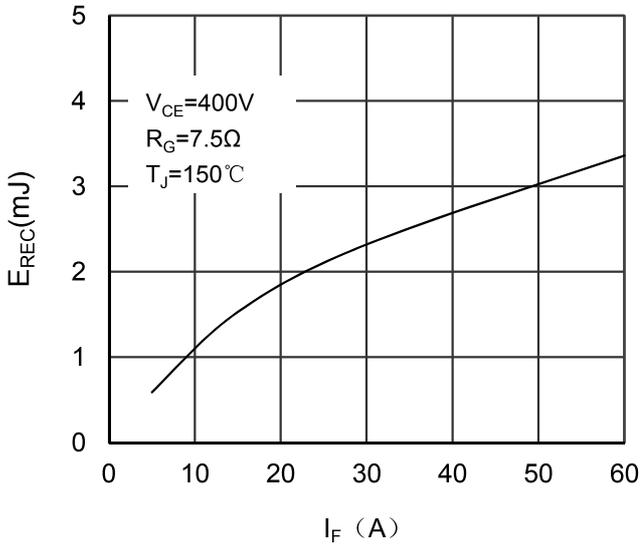


Figure 9. Switching Energy vs Forward Current Half Bridge Diode

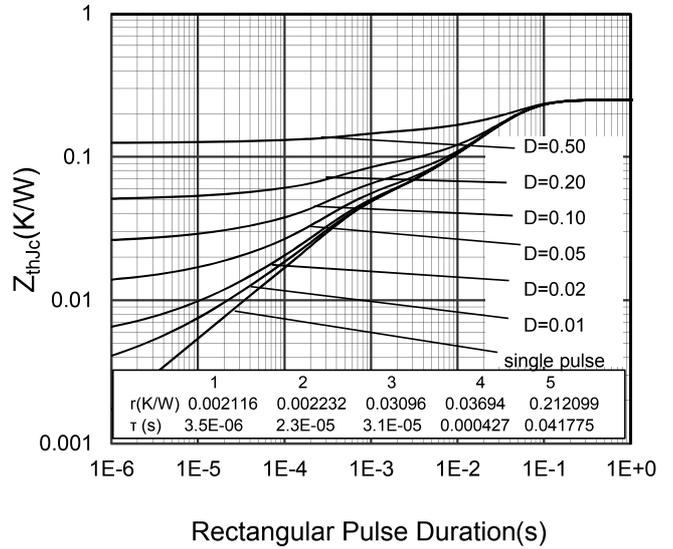


Figure 10. Transient Thermal Impedance of Half Bridge IGBT

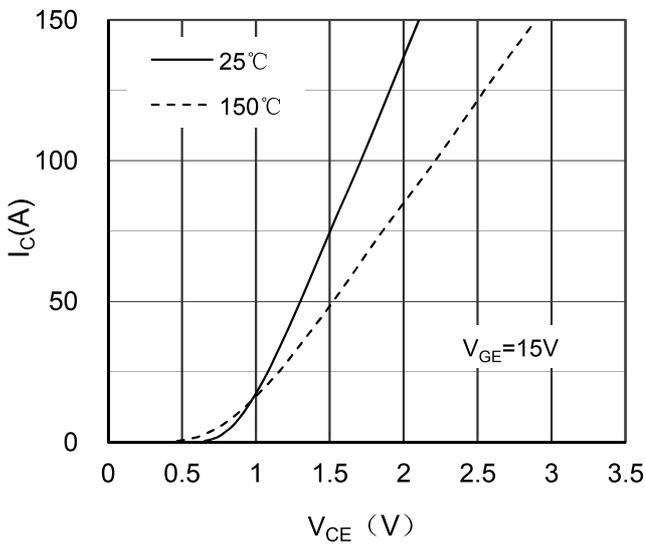


Figure 11. Typical Output Characteristics Neutral Point IGBT

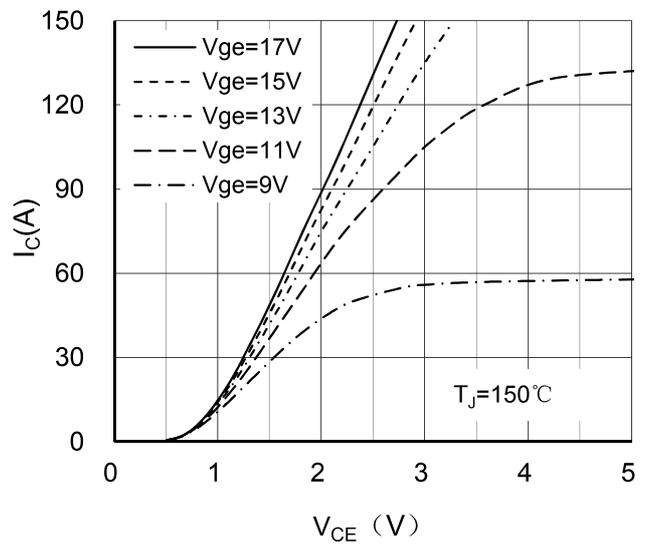


Figure 12. Typical Output Characteristics Neutral Point IGBT

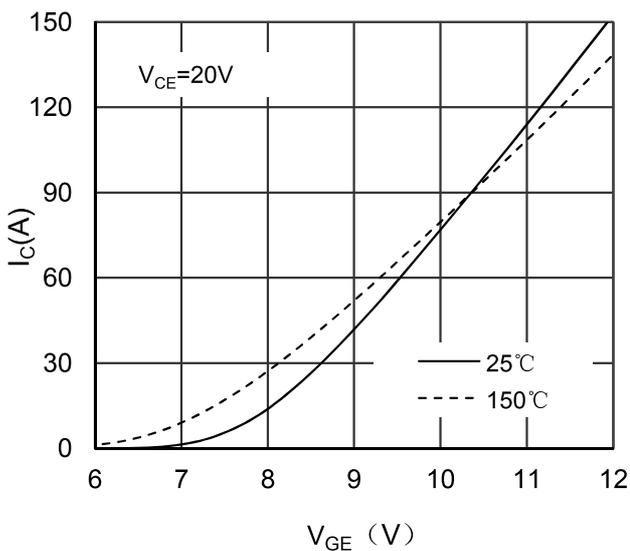


Figure 13. Typical Transfer characteristics Neutral Point IGBT

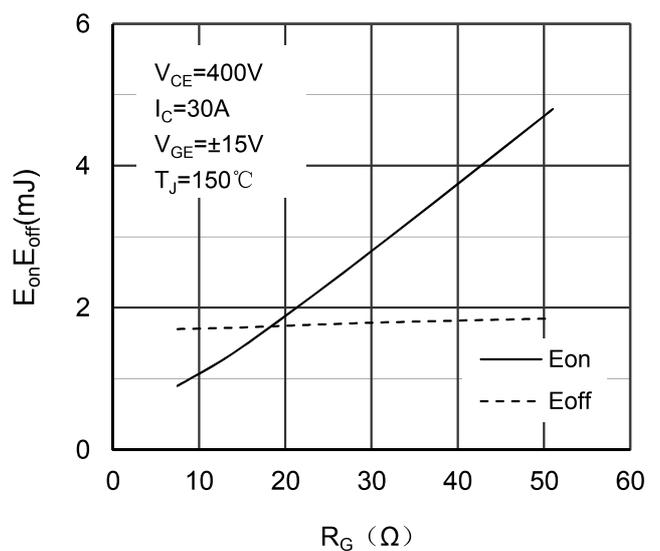


Figure 14. Switching Energy vs Gate Resistor Neutral Point IGBT

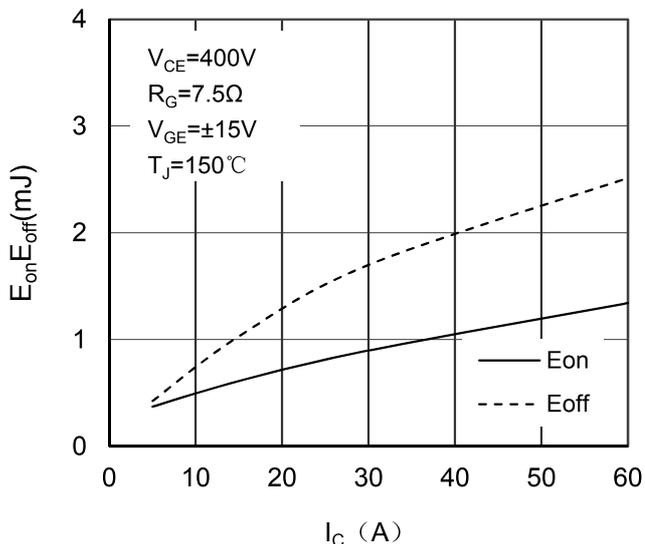


Figure 15. Switching Energy vs Collector Current Neutral Point IGBT

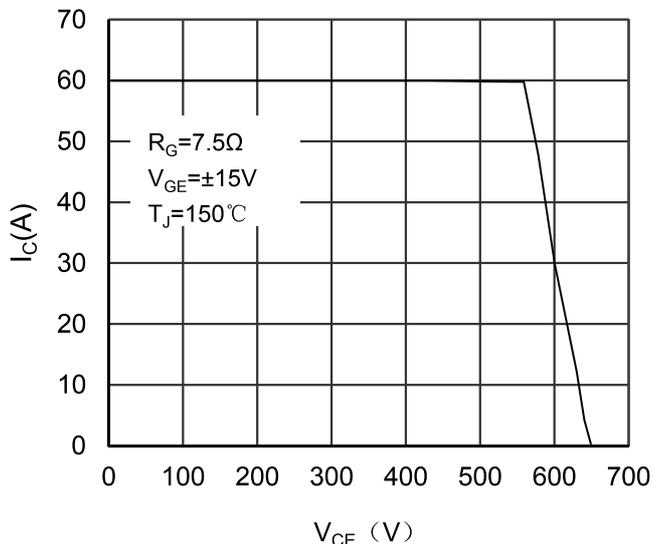


Figure 16. Reverse Biased Safe Operating Area Neutral Point IGBT

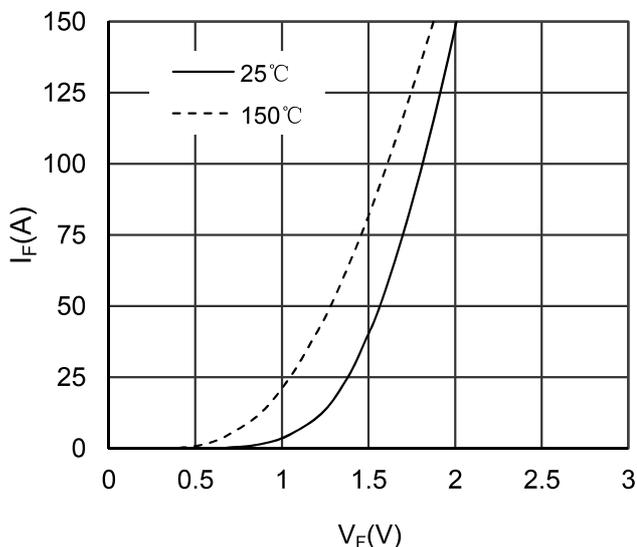


Figure 17. Diode Forward Characteristics Neutral Point Diode

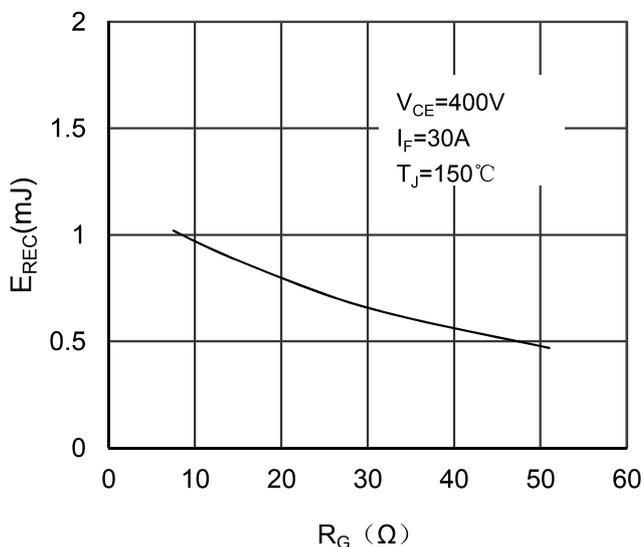


Figure 18. Switching Energy vs Gate Resistor Neutral Point Diode

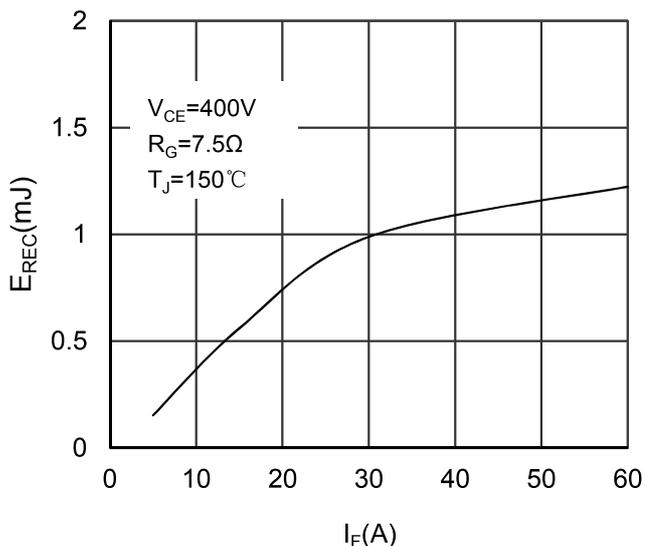


Figure 19. Switching Energy vs Forward Current Neutral Point Diode

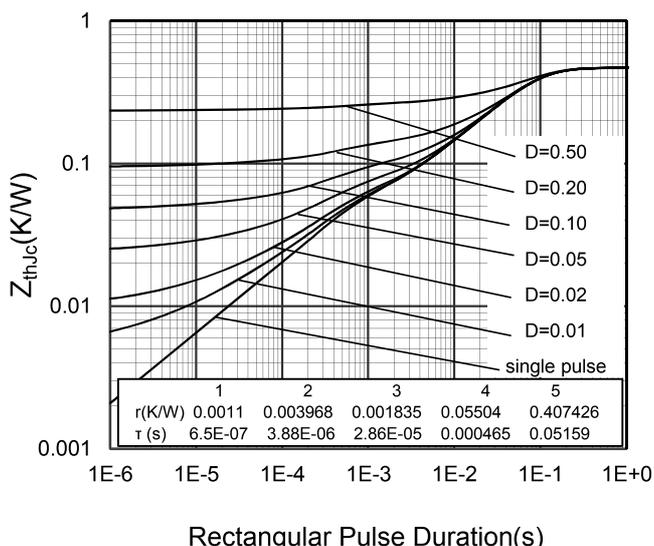


Figure 20. Transient Thermal Impedance of Neutral Point IGBT

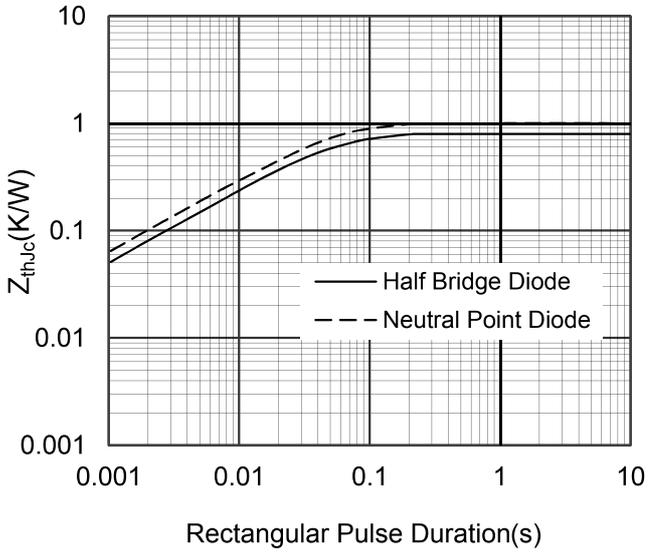


Figure 20. Transient Thermal Impedance of Diode

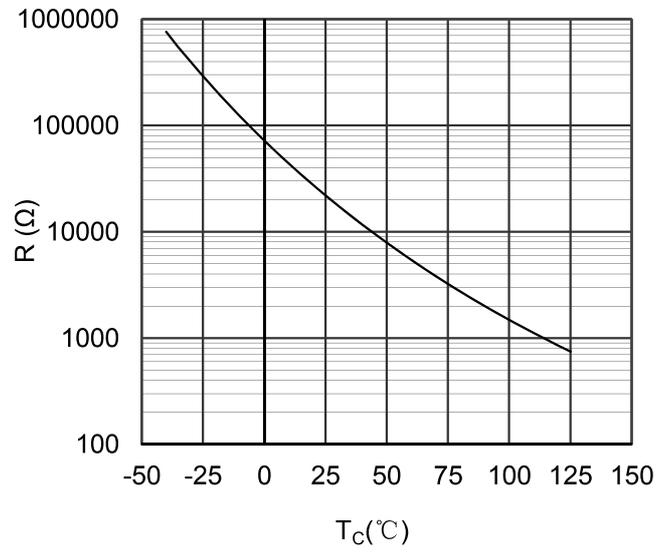


Figure 21. NTC Characteristics

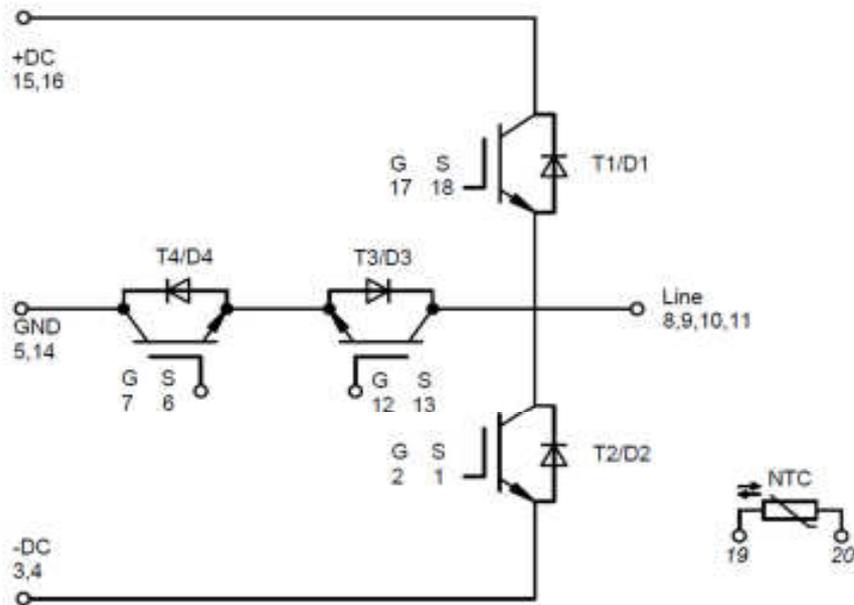
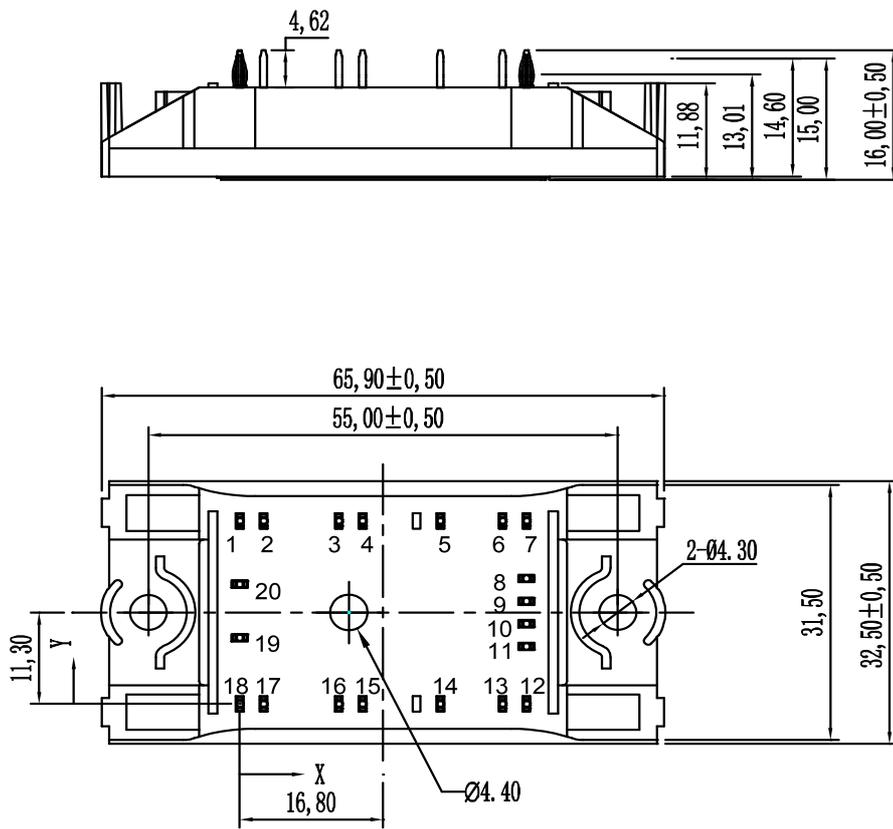


Figure 22. Circuit Diagram



Pin table		
Pin	X	Y
1	0	22.6
2	2.8	22.6
3	11.6	22.6
4	14.4	22.6
5	23.5	22.6
6	30.8	22.6
7	33.6	22.6
8	33.6	15.5
9	33.6	12.7
10	33.6	9.9
11	33.6	7.1
12	33.6	0
13	30.8	0
14	23.5	0
15	14.4	0
16	11.6	0
17	2.8	0
18	0	0
19	0	7.8
20	0	14.4

Dimensions in (mm)
Figure 23. Package Outline