

Features

- Low Switching Losses
- Maximum Junction Temperature 175 °C
- Positive Temperature Coefficient
- High Ruggedness, Temperature Stable
- Halogen Free. "Green" Device (Note 1)
- Epoxy Meets UL 94 V-0 Flammability Rating
- Lead Free Finish/RoHS Compliant (Note 2)("P" Suffix Designates RoHS Compliant. See Ordering Information)

Maximum Ratings

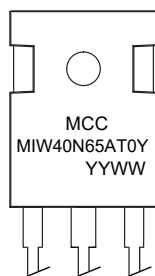
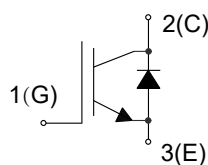
- Operating Junction Temperature Range : -40°C to +175°C
- Storage Temperature Range: -55°C to +150°C
- IGBT Thermal Resistance: 0.8°C/W Junction to Case
- Diode Thermal Resistance: 1.05°C/W Junction to Case
- Thermal Resistance: 40°C/W Junction to Ambient

Parameter	Symbol	Rating	Unit
Collector-Emitter Voltage	V_{CE}	650	V
DC Collector Current ⁽³⁾	I_C	$T_C=25^{\circ}\text{C}$ 80	A
		$T_C=100^{\circ}\text{C}$ 40	
Pulsed Collector Current ⁽⁴⁾ , $V_{GE}=15\text{V}$	$I_{C,pluse}$	160	A
Diode Forward Current ⁽³⁾	I_F	$T_C=25^{\circ}\text{C}$ 80	A
		$T_C=100^{\circ}\text{C}$ 40	
Diode Pulsed Current ⁽⁴⁾	$I_{F,pluse}$	160	A
Continuous Gate-Emitter Voltage	V_{GE}	±20	V
Transient Gate-Emitter Voltage ⁽⁵⁾		±30	
Power Dissipation	$T_C=25^{\circ}\text{C}$	187	W
	$T_j=175^{\circ}\text{C}$		

Note:

1. Halogen free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
2. High Temperature Solder Exemptions Applied, see EU Directive Annex 7a.
3. Limited by T_{Jmax} .
4. t_p limited by T_{Jmax} .
5. $t_p \leq 10\mu\text{s}$, Duty Cycle < 1%

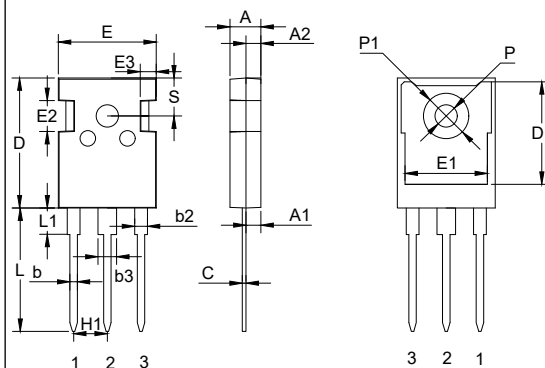
Internal Structure



Device Code: MIW40N65AT0Y
Date Code: YYWW: (Year & Week)

Trench and Field Stop IGBT 650V 40A

TO-247AB



DIMENSIONS

DIM	INCHES		MM		NOTE
	MIN	MAX	MIN	MAX	
A	0.189	0.205	4.80	5.20	
A1	0.087	0.103	2.21	2.61	
A2	0.073	0.085	1.85	2.15	
b	0.039	0.055	1.00	1.40	
b2	0.075	0.087	1.91	2.21	
C	0.020	0.028	0.50	0.70	
D	0.815	0.839	20.70	21.30	
D1	0.640	0.663	16.25	16.85	
E	0.610	0.634	15.50	16.10	
E1	0.512	0.535	13.00	13.60	
E2	0.189	0.205	4.80	5.20	
E3	0.091	0.106	2.30	2.70	
L	0.772	0.796	19.62	20.22	
L1	-	0.169	-	4.30	
P	0.134	0.150	3.40	3.80	Φ
P1	-	0.287	-	7.30	Φ
S	0.242		6.15		TYP
H1	0.214		5.44		TYP
b3	0.110	0.126	2.80	3.20	

Electrical Characteristics @ 25°C (Unless Otherwise Specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
IGBT Static Characteristics						
Collector-Emitter Breakdown Voltage	$V_{(BR)CES}$	$V_{GE}=0V, I_C=250\mu A$	650			V
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$V_{GE}=15V, I_C=40A, T_J=25^\circ C$		1.55	1.95	V
		$V_{GE}=15V, I_C=40A, T_J=125^\circ C$		1.75		
		$V_{GE}=15V, I_C=40A, T_J=150^\circ C$		1.85		
G-E Threshold Voltage	$V_{GE(th)}$	$I_C=0.75mA, V_{CE}=V_{GE}$	4.3	5.3	6.3	V
C-E Leakage Current	I_{CES}	$V_{CE}=650V, V_{GE}=0V, T_J=25^\circ C$			0.25	mA
		$V_{CE}=650V, V_{GE}=0V, T_J=150^\circ C$			4	
G-E Leakage Current	I_{GES}	$V_{CE}=0V, V_{GE}=\pm 20V$			100	nA
Dynamic Characteristics						
Input Capacitance	C_{ies}	$V_{CE}=25V, V_{GE}=0V, f=1MHz$		2.18		nF
Reverse Transfer Capacitance	C_{res}			0.03		
Gate Charge	Q_G	$V_{CC}=300V, I_C=40A, V_{GE}=15V$		0.20		μC
IGBT Switching Characteristics						
Turn-On Delay Time	$t_{d(on)}$	$V_{CC}=300V, I_C=40A, V_{GE}=-5V\sim 15V, R_G=20\Omega, T_J=25^\circ C$		19		ns
Rise Time	t_r			65		
Turn-Off Delay Time	$t_{d(off)}$			129		
Fall Time	t_f			48		
Turn-On Energy	E_{on}	$V_{CC}=300V, I_C=40A, V_{GE}=-5V\sim 15V, R_G=20\Omega, T_J=25^\circ C$		1.27		mJ
Turn-Off Energy	E_{off}			0.46		
Turn-On Delay Time	$t_{d(on)}$			18		ns
Rise Time	t_r			63		
Turn-Off Delay Time	$t_{d(off)}$	$V_{CC}=300V, I_C=40A, V_{GE}=-5V\sim 15V, R_G=20\Omega, T_J=125^\circ C$		137		
Fall Time	t_f			79		
Turn-On Energy	E_{on}			1.29		mJ
Turn-Off Energy	E_{off}			0.57		
Turn-On Delay Time	$t_{d(on)}$	$V_{CC}=300V, I_C=40A, V_{GE}=-5V\sim 15V, R_G=20\Omega, T_J=150^\circ C$		18		ns
Rise Time	t_r			61		
Turn-Off Delay Time	$t_{d(off)}$			140		
Fall Time	t_f			91		
Turn-On Energy	E_{on}			1.31		mJ
Turn-Off Energy	E_{off}			0.61		

Electrical Characteristics @ 25°C (Unless Otherwise Specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Diode Characteristics						
Diode Forward Voltage	V_F	$V_{GE}=0V, I_F=40A, T_j=25^{\circ}C$		2.1	2.6	V
		$V_{GE}=0V, I_F=40A, T_j=125^{\circ}C$		1.85		
		$V_{GE}=0V, I_F=40A, T_j=150^{\circ}C$		1.75		
Reverse Recovery Current	I_{rr}	$V_R=300V, I_F=40A,$ $di_F/dt=-400A/\mu s, T_j=25^{\circ}C$		5		A
Diode Reverse Recovery Time	t_{rr}			68		ns
Reverse Recovery Charge	Q_{rr}			0.28		μC
Reverse Recovery Energy	E_{rec}			0.04		mJ
Reverse Recovery Current	I_{rr}	$V_R=300V, I_F=40A,$ $di_F/dt=-400A/\mu s, T_j=125^{\circ}C$		7		A
Diode Reverse Recovery Time	t_{rr}			153		ns
Reverse Recovery Charge	Q_{rr}			0.78		μC
Reverse Recovery Energy	E_{rec}			0.09		mJ
Reverse Recovery Current	I_{rr}	$V_R=300V, I_F=40A,$ $di_F/dt=-400A/\mu s, T_j=150^{\circ}C$		9		A
Diode Reverse Recovery Time	t_{rr}			194		ns
Reverse Recovery Charge	Q_{rr}			0.96		μC
Reverse Recovery Energy	E_{rec}			0.12		mJ

Curve Characteristics

Fig1. Power dissipation as a function of case temperature ($T_j \leq 175^\circ\text{C}$)

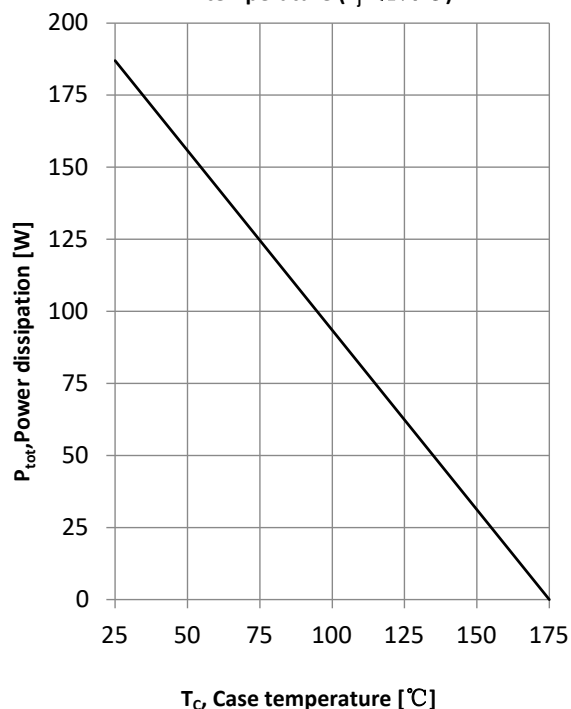


Fig2. Collector current as a function of case temperature ($V_{\text{GE}} \geq 15\text{V}$, $T_j \leq 175^\circ\text{C}$)

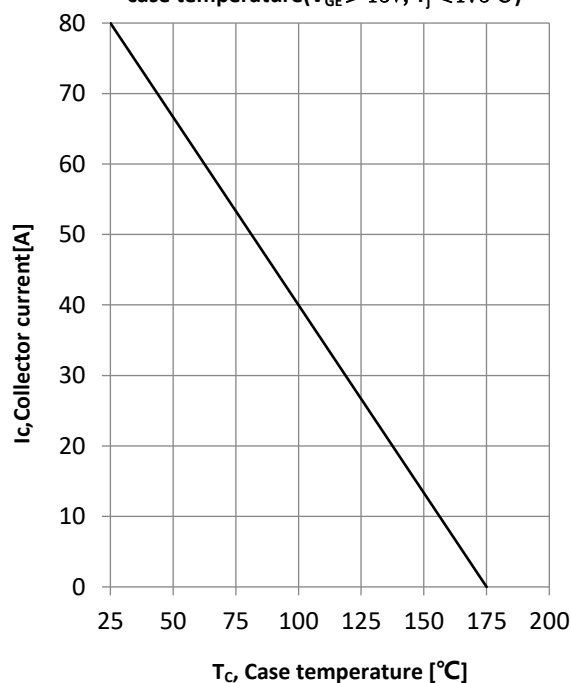


Fig3. Typical output characteristic ($T_j = 25^\circ\text{C}$)

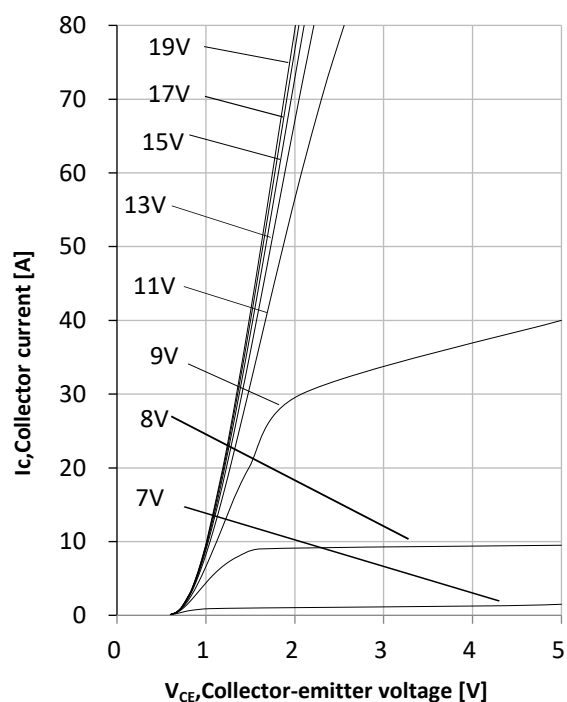
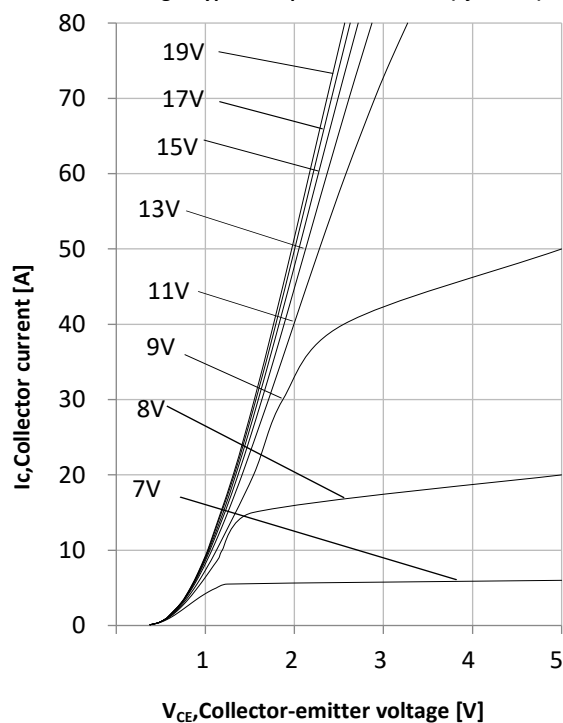


Fig4. Typical output characteristic ($T_j = 150^\circ\text{C}$)



Curve Characteristics

Fig5. Typical transfer characteristic ($V_{CE}=20V$)

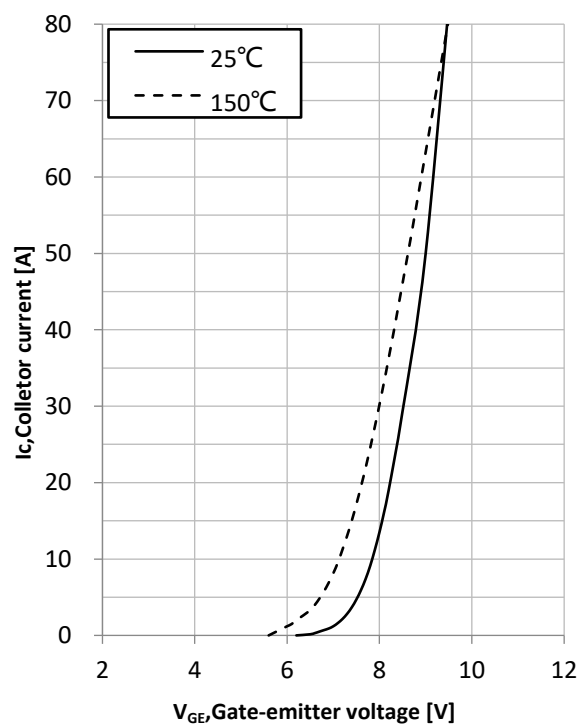


Fig6. Typical collector-emitter saturation voltage as a function of junction temperature ($V_{GE}=15V$)

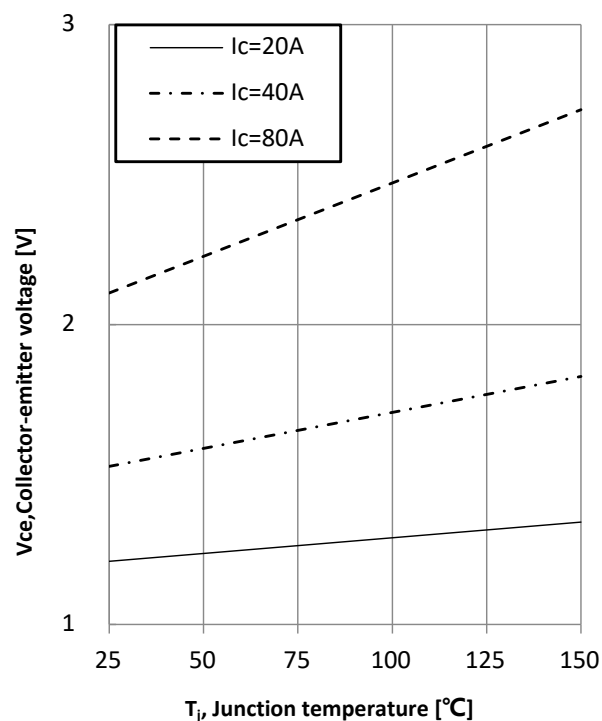


Fig7. Typical switching time as a function of collector current

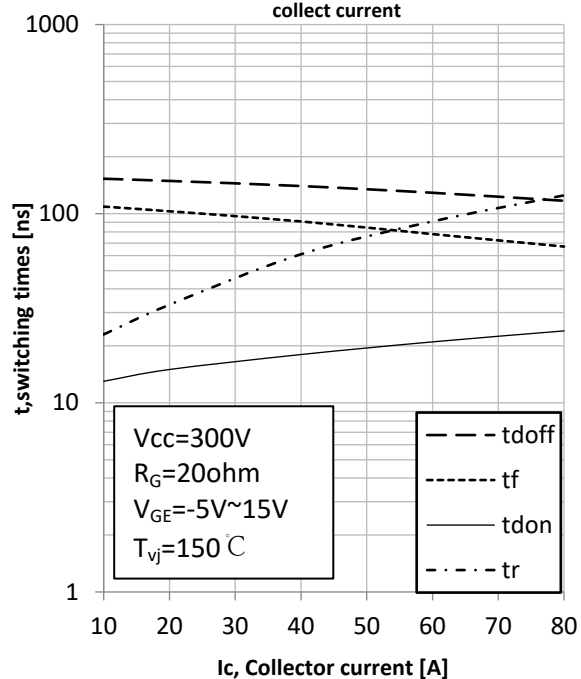
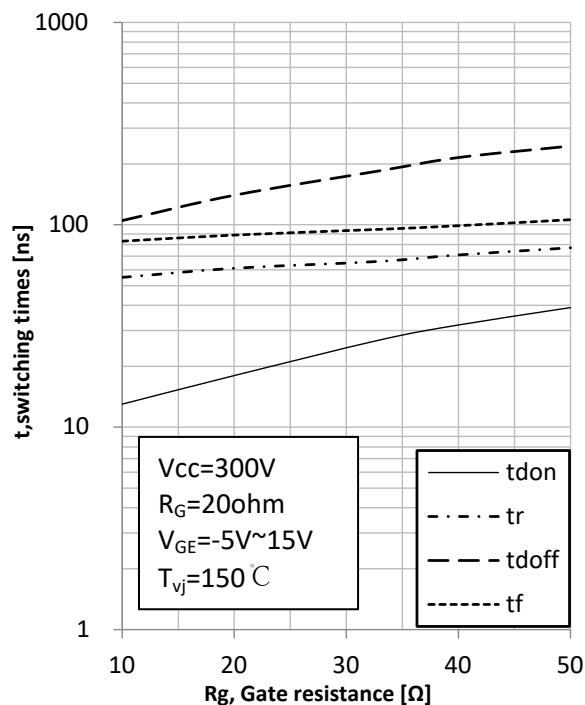


Fig8. Typical switching times as a function of gate resistance



Curve Characteristics

Fig9. Typical switching times as a function of junction temperature

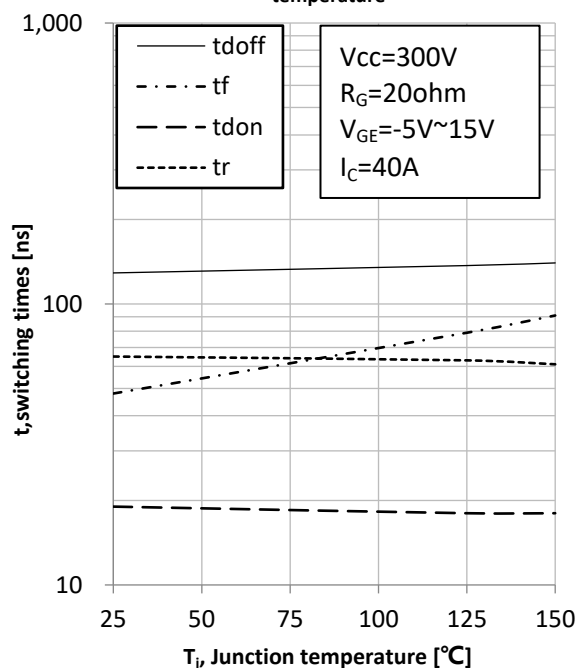


Fig10. Gate-emitter threshold voltage as a function of Junction temperature ($I_C=0.75mA$)

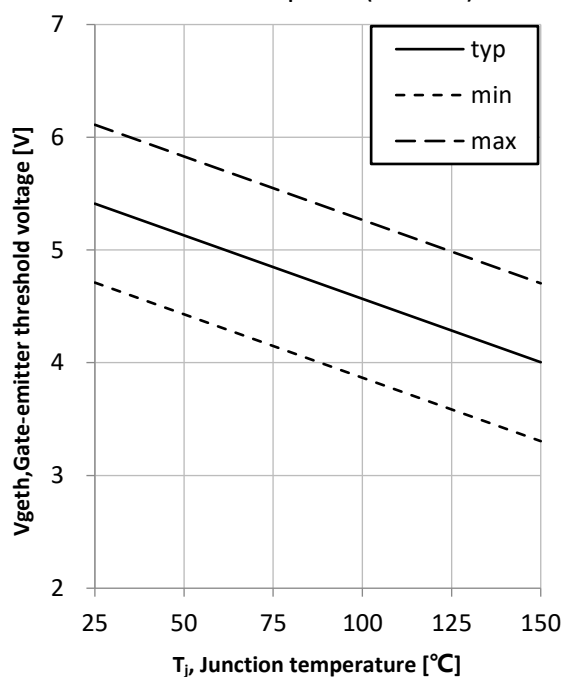


Fig11. Typical switching energy losses as a function of collector current

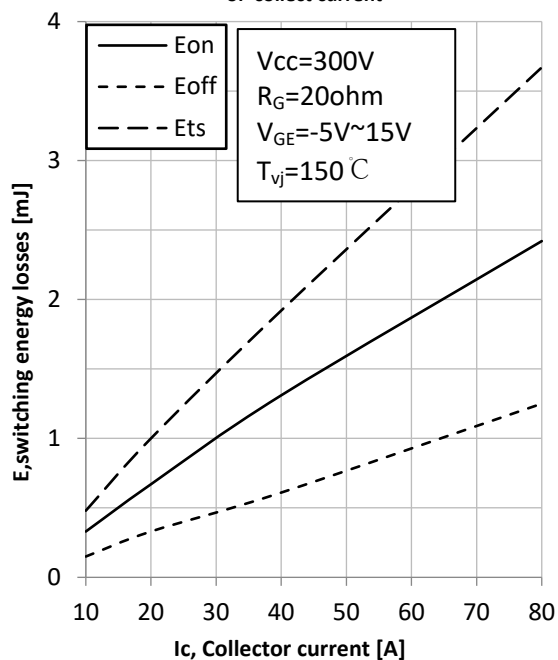


Fig12. Typical switching energy losses as a function of gate resistance

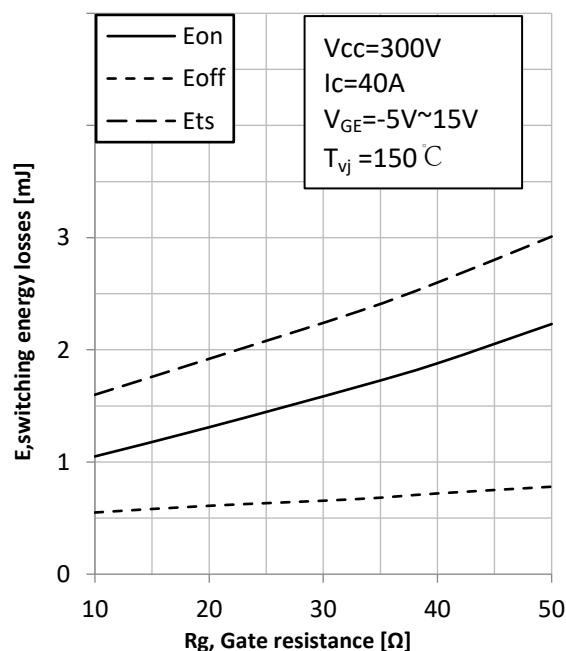


Fig13. Typical switching energy losses as a fuction of Junction temperature

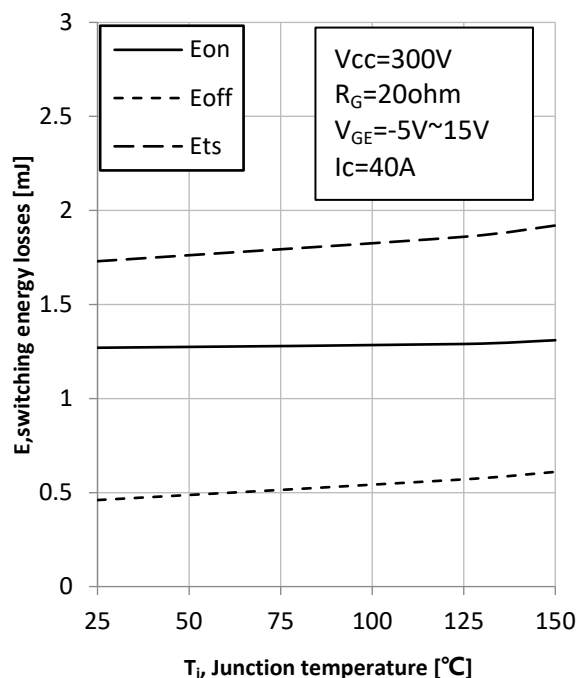


Fig14. Typical switching energy losses as a fuction of collector-emitter voltage

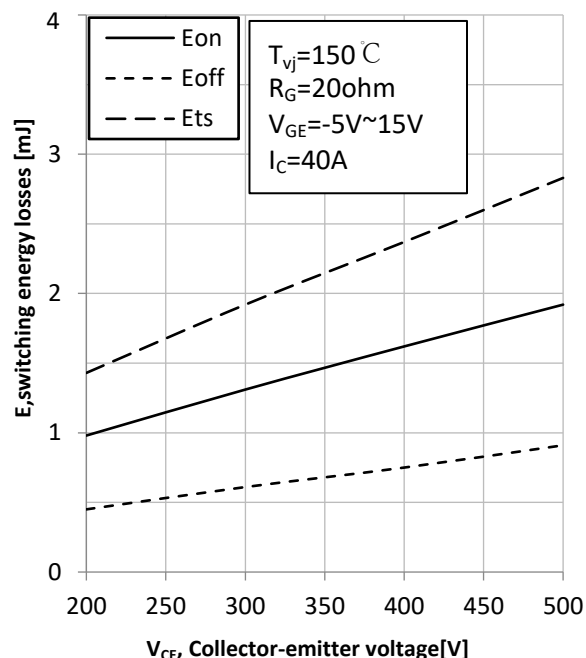


Fig15. Typical capacitance as a function of collector-emitter voltage

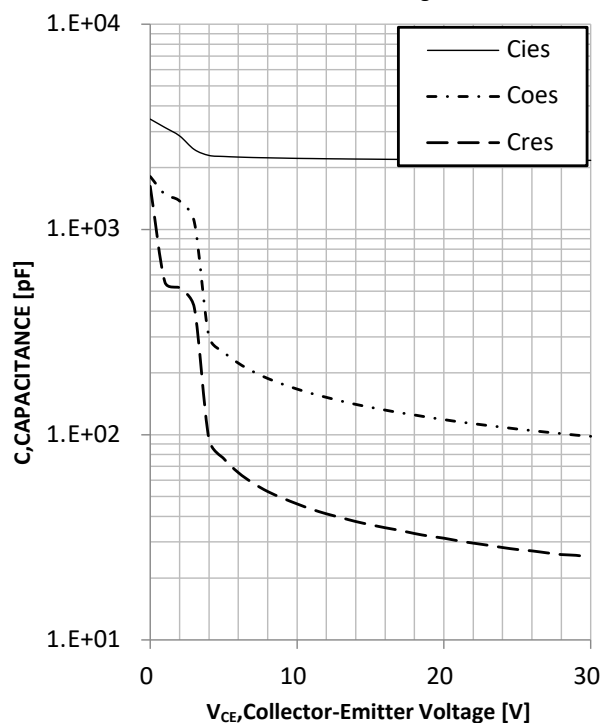


Fig 16. IGBT Transient Thermal Impedance

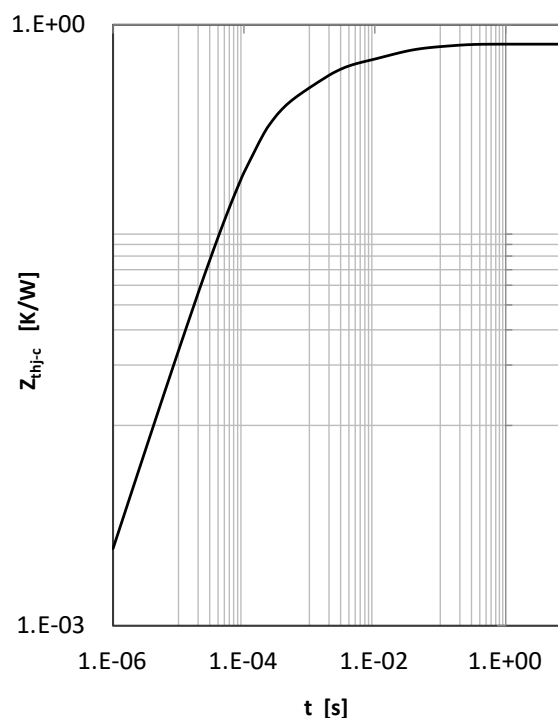


Fig 17. Diode Transient Thermal Impedance

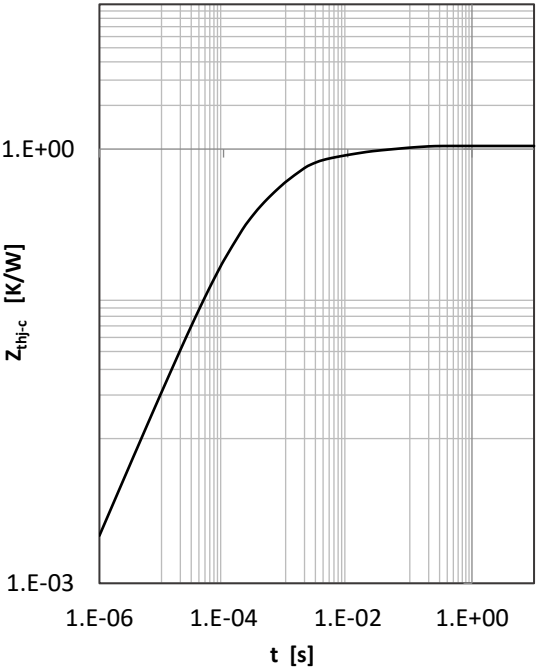


Fig18. Diode forward current as a function of forward voltage

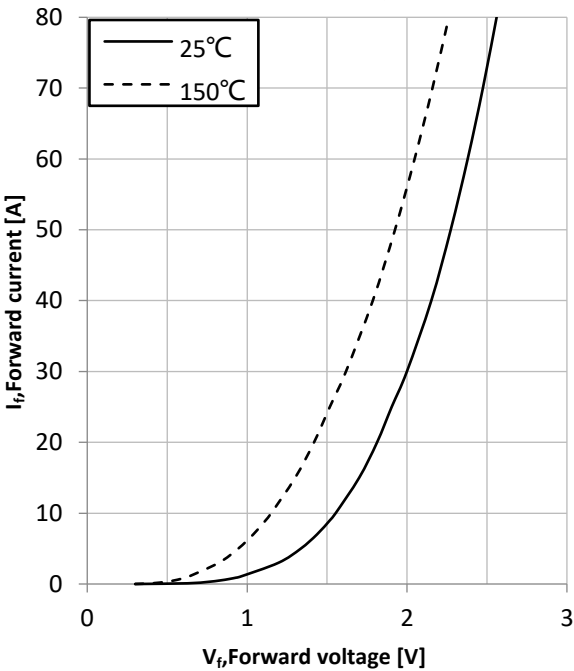
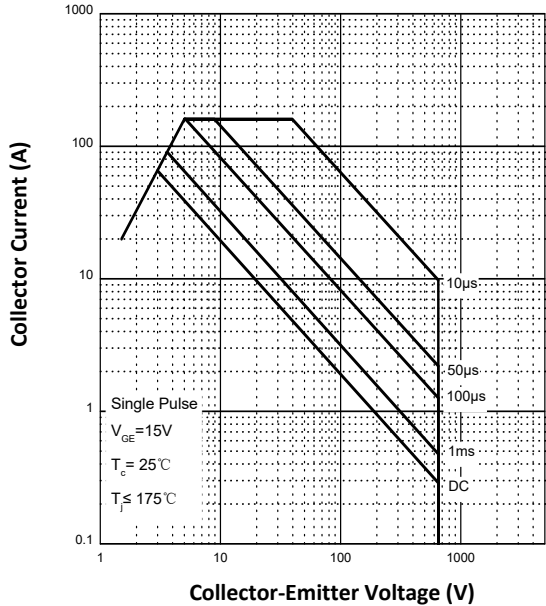


Fig. 19 -FBSOA



Ordering Information

Device	Packing
Part Number-BP	Tube: 30pcs/Tube, 1800pcs/Ctn

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