

Insulated Gate Bipolar Transistor

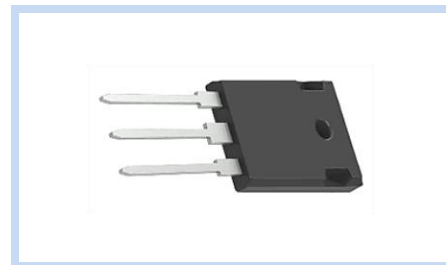
650V 80A 283W TO-247

MIG65N80PT247

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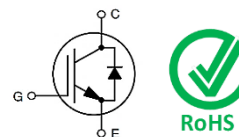
FEATURE

- High Speed Switching Device for Smooth Hard and Soft Switching
- Positive Temperature Coefficient
- High Ruggedness, Temperature Stable
- Application: Solar and Welding Converters, Uninterruptible Power Supplies, Mid to High Range Switching Frequency Converters



MECHANICAL DATA

- Case: TO-247 Package
- Terminals: Solderable per MIL-STD-750, Method 2026



MAXIMUM RATINGS

Parameter		Symbol	Value	Unit
Collector-to-Emitter Breakdown Voltage		V_{CES}	650	V
Gate-to-Emitter Voltage		V_{GE}	± 20	V
Collector Current – Continuous	$T_C = 25^\circ\text{C}$	I_C	80	A
	$T_C = 100^\circ\text{C}$		50	
Collector Current – Pulsed	tp limited by T_{Jmax} , $V_{GE} = 15\text{V}$	I_{CM}	200	A
Diode Forward Current – Continuous	$T_C = 25^\circ\text{C}$	I_F	80	A
	$T_C = 100^\circ\text{C}$		50	
Diode Forward Current – Pulsed		I_{FM}	200	A
Turn off Safe Operating Area	$V_{CE} \leq 650\text{V}$, $T_J \leq 150^\circ\text{C}$	-	200	A
Power Dissipation	$T_J = 175^\circ\text{C}$	P_D	283	W
Thermal Resistance Junction to Case For Diode		$R_{\theta jc}$	1.05	$^\circ\text{C/W}$
Thermal Resistance Junction to Case For IGBT		$R_{\theta jc}$	0.53	$^\circ\text{C/W}$
Soldering Temperature		T_L	260	$^\circ\text{C}$
Operating Junction Temperature Range		T_J	-40 to 175	$^\circ\text{C}$
Storage Temperature Range		T_{STG}	-55 to 150	$^\circ\text{C}$

Note:

1. $T_C = 25^\circ\text{C}$ unless otherwise noted

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ELECTRICAL CHARACTERISTICS - IGBT

Static Characteristics	Conditions	Symbol	Min	Typ.	Max	Unit
Collector-Emitter Breakdown Voltage	$V_{GE}=0V, I_C=250\mu A$	BV_{CES}	650	--	--	V
Collector-Emitter Leakage Current	$V_{GE} = 0V, V_{CE}=650V$	I_{CES}	--	--	0.25	mA
	$V_{GE} = 0V, V_{CE}=650V, T_j=150^\circ C$		--	--	3	
Gate to Emitter Leakage Current	$V_{GE} = \pm 20V, V_{CE} = 0V$	I_{GES}	--	--	100	nA
Collector-Emitter Saturation Voltage	$V_{GE}=15V, I_C=50A$	$V_{CE(SAT)}$	1.3	1.6	1.9	V
	$V_{GE}=15V, I_C=50A, T_j=125^\circ C$		--	1.8	--	
	$V_{GE}=15V, I_C=50A, T_j=150^\circ C$		--	1.9	--	
Gate Threshold Voltage	$V_{CE}=V_{GE}, I_C=0.5mA$	$V_{GE(th)}$	3.8	4.8	5.8	V
Dynamic Characteristics	Conditions	Symbol	Min	Typ.	Max	Unit
Total Gate Charge	$V_{CC}=520V, V_{GE}=15V, I_C=50A$	Q_g	--	0.14	--	μC
Input Capacitance	$V_{CE}=25V, V_{GE}=0V, F=1MHz$	C_{ies}	--	2.83	--	nF
Reverse Transfer Capacitance		C_{res}	--	0.02	--	
Switching Characteristics	Conditions	Symbol	Min	Typ.	Max	Unit
Turn-On Delay Time	$V_{CC}=400V, V_{GE}=-5V\sim 15V, I_C=50A, R_G=10\Omega, \text{Inductive Load}$	$T_{d(on)}$	--	24	--	ns
Rise Time		T_r	--	31	--	
Turn-Off Delay Time		$T_{d(off)}$	--	74	--	
Fall Time		T_f	--	35	--	
Turn-On Switching Loss		E_{on}	--	2.05	--	mJ
Turn-Off Switching Loss	$V_{CC}=400V, V_{GE}=-5V\sim 15V, I_C=50A, R_G=10\Omega, \text{Inductive Load, } T_j=125^\circ C$	E_{off}	--	0.36	--	
Total Switching Energy		E_{ts}	--	2.47	--	
Turn-On Delay Time		$T_{d(on)}$	--	24	--	ns
Rise Time		T_r	--	42	--	
Turn-Off Delay Time		$T_{d(off)}$	--	82	--	
Fall Time		T_f	--	41	--	
Turn-On Switching Loss	$V_{CC}=400V, V_{GE}=-5V\sim 15V, I_C=50A, R_G=10\Omega, \text{Inductive Load, } T_j=150^\circ C$	E_{on}	--	2.11	--	mJ
Turn-Off Switching Loss		E_{off}	--	0.44	--	
Total Switching Energy		E_{ts}	--	2.56	--	
Turn-On Delay Time		$T_{d(on)}$	--	25	--	ns
Rise Time		T_r	--	48	--	
Turn-Off Delay Time		$T_{d(off)}$	--	88	--	
Fall Time		T_f	--	44	--	
Turn-On Switching Loss		E_{on}	--	2.19	--	mJ
Turn-Off Switching Loss		E_{off}	--	0.47	--	
Total Switching Energy		E_{ts}	--	2.66	--	

Note:

1. $T_j = 25^\circ C$ unless otherwise noted

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ELECTRICAL CHARACTERISTICS - DIODE

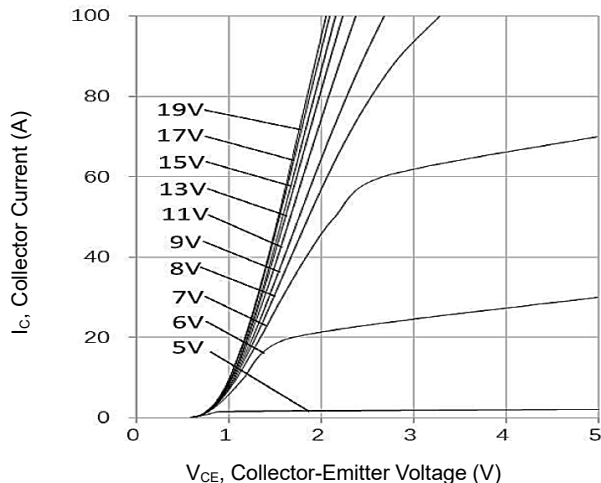
Switching Characteristics	Conditions	Symbol	Min	Typ.	Max	Unit
Diode Forward Voltage	$I_F=50A$	V_F	--	1.6	2.0	V
	$I_F=50A, T_J=125^{\circ}C$		--	1.5	--	
	$I_F=50A, T_J=150^{\circ}C$		--	1.4	--	
Diode Reverse Recovery Time	$I_F=50A, V_R=400V,$ $di_F/dt = -450A/\mu s$	t_{rr}	--	148	--	ns
Reverse Recovery Charge		Q_{rr}	--	1.58	--	μC
Reverse Recovery Current		I_{rr}	--	15	--	A
Reverse Recovery Energy		E_{rec}		0.29		mJ
Diode Reverse Recovery Time	$I_F=50A, V_R=400V,$ $di_F/dt = -450A/\mu s, T_J=125^{\circ}C$	t_{rr}	--	183	--	ns
Reverse Recovery Charge		Q_{rr}	--	2.54	--	μC
Reverse Recovery Current		I_{rr}	--	21	--	A
Reverse Recovery Energy		E_{rec}		0.65		mJ
Diode Reverse Recovery Time	$I_F=50A, V_R=400V,$ $di_F/dt = -450A/\mu s, T_J=150^{\circ}C$	t_{rr}	--	218	--	ns
Reverse Recovery Charge		Q_{rr}	--	3.59	--	μC
Reverse Recovery Current		I_{rr}	--	24	--	A
Reverse Recovery Energy		E_{rec}		0.79		mJ

Note:

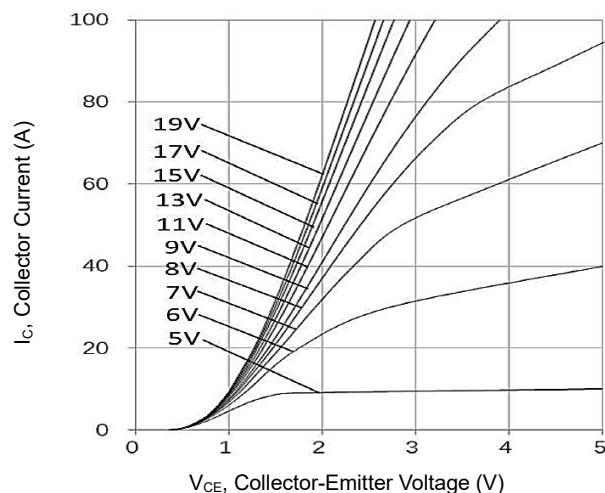
2. $T_J = 25^{\circ}C$ unless otherwise noted

CHARACTERISTIC CURVES

Output Characteristics($T_J=25^{\circ}C$)



Output Characteristics($T_J=150^{\circ}C$)



CHARACTERISTIC CURVES

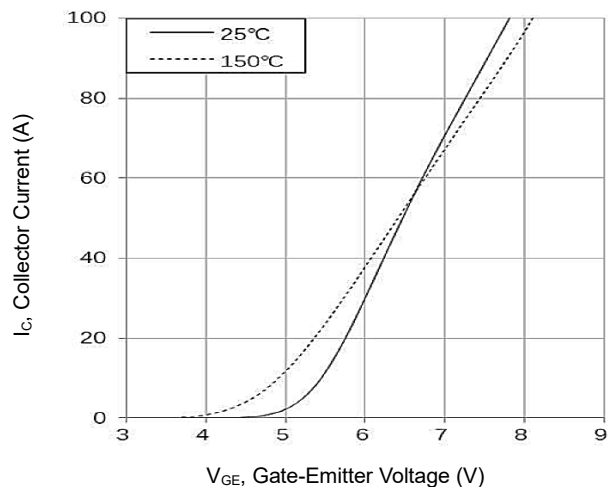
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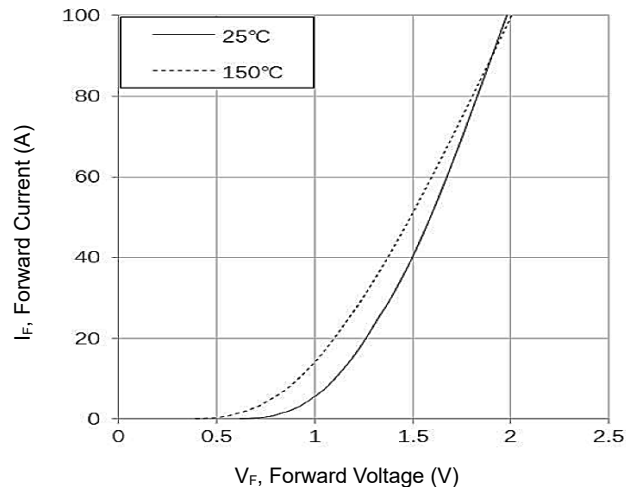
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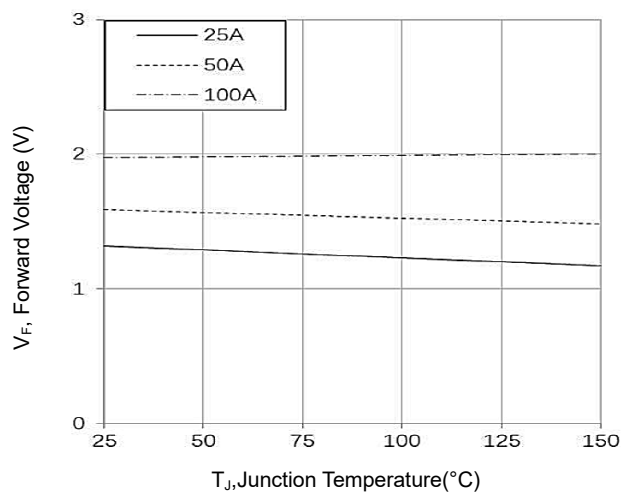
Transfer Characteristics



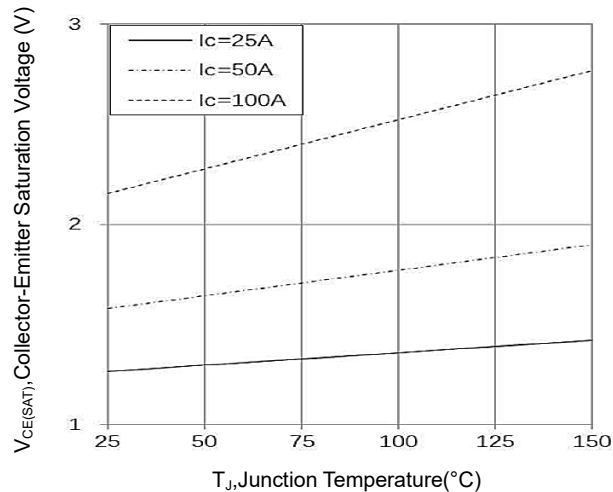
Diode Forward Characteristics



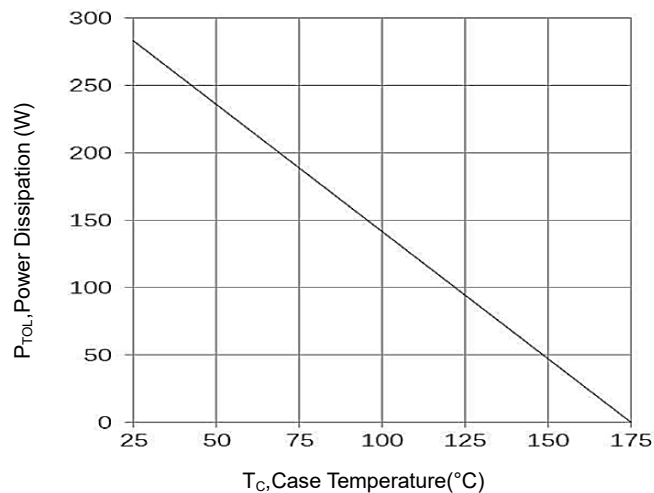
Diode Forward Voltage Variation



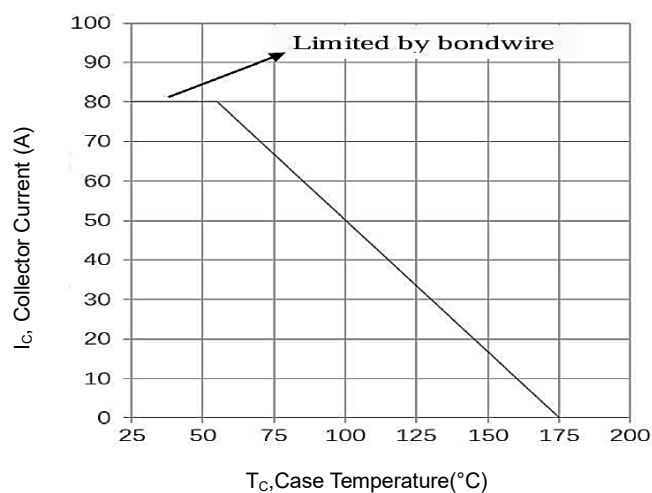
Collector-Emitter Saturation Voltage



Power Dissipation



Collector Current



CHARACTERISTIC CURVES

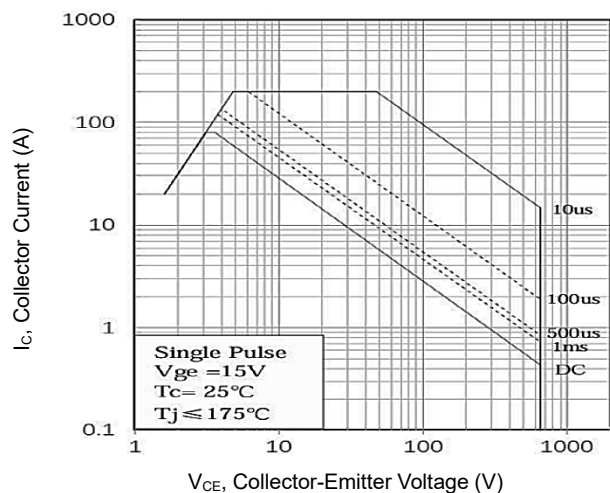
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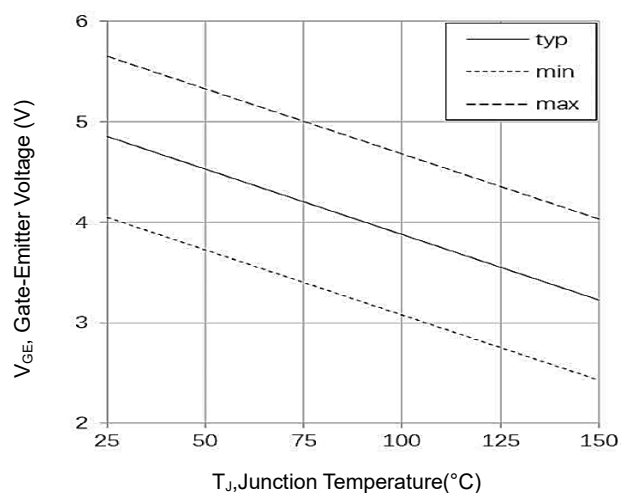
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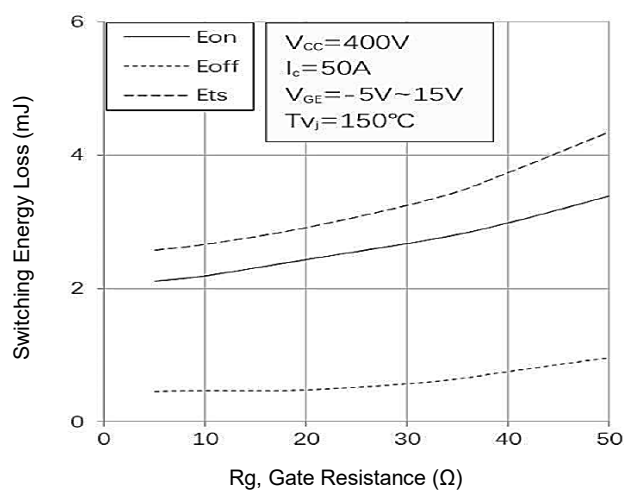
FBSOA



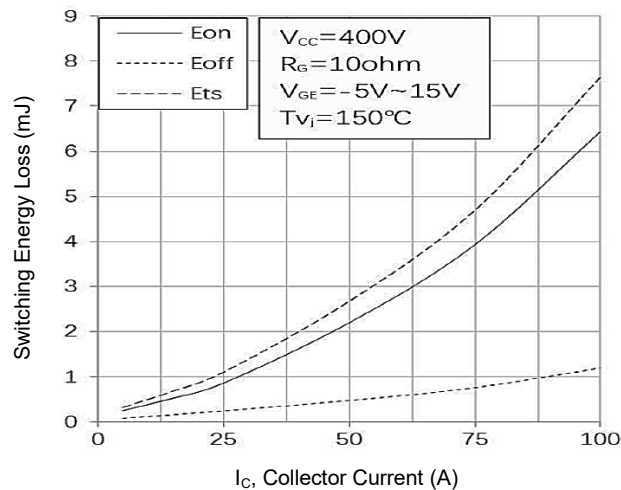
Gate-Emitter Voltage vs Junction Temperature



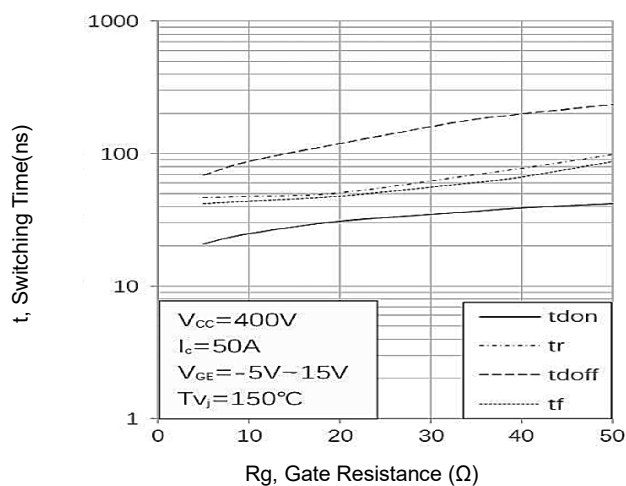
Switching Energy Loss vs Gate Resistances



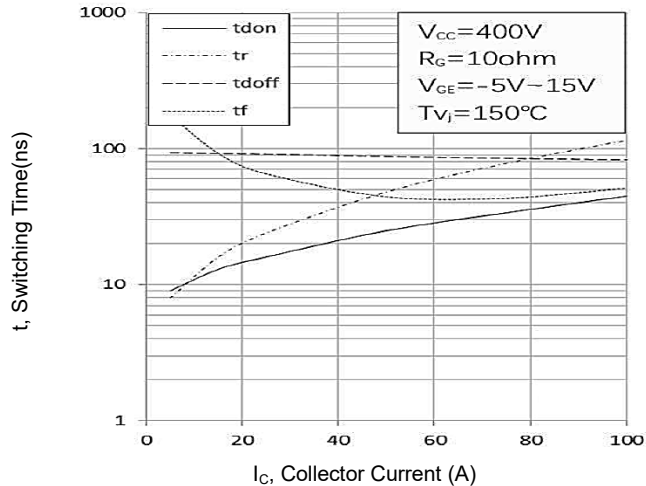
Switching Energy Loss vs Collect Current



Switching Times vs Gate Resistances



Switching Times vs Collect Current



CHARACTERISTIC CURVES

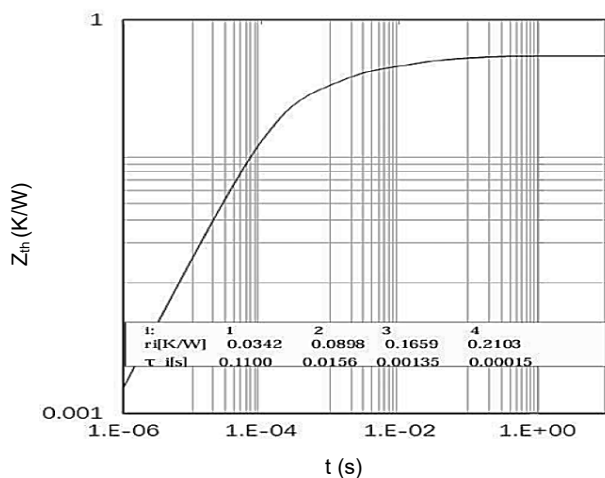
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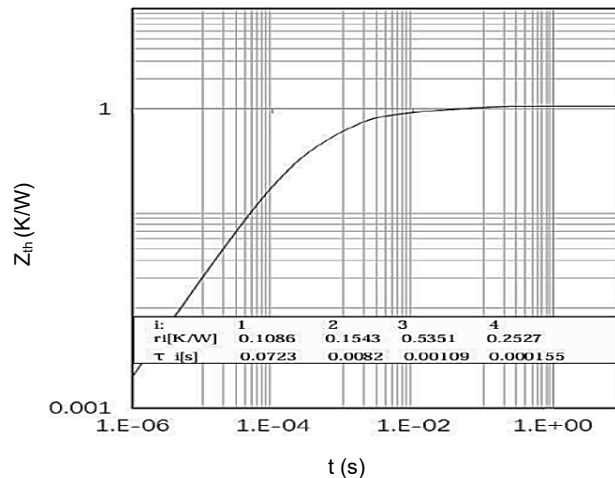
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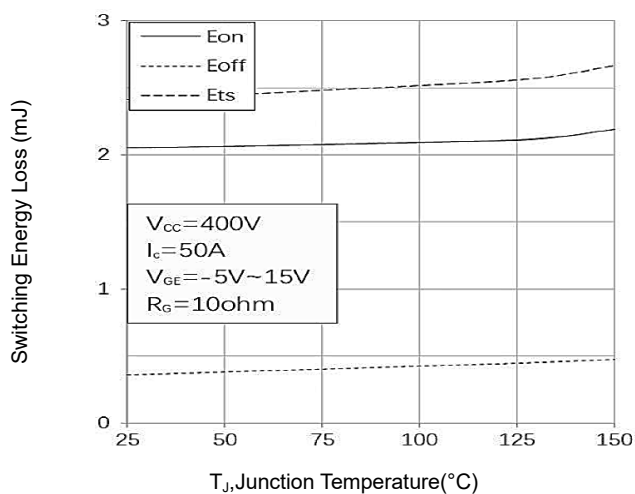
IGBT Transient Thermal Impedance



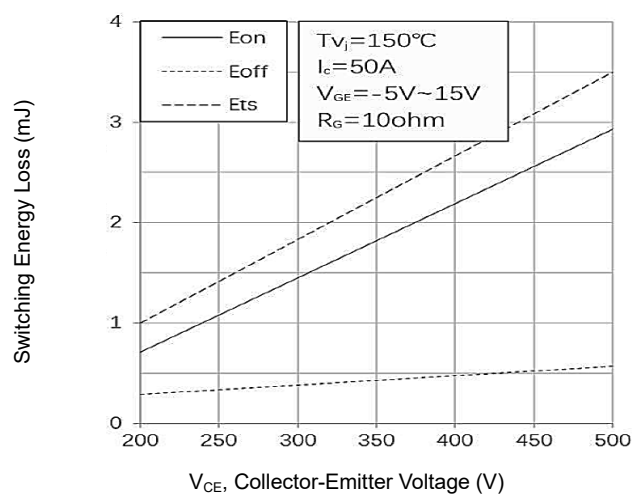
Diode Transient Thermal Impedance



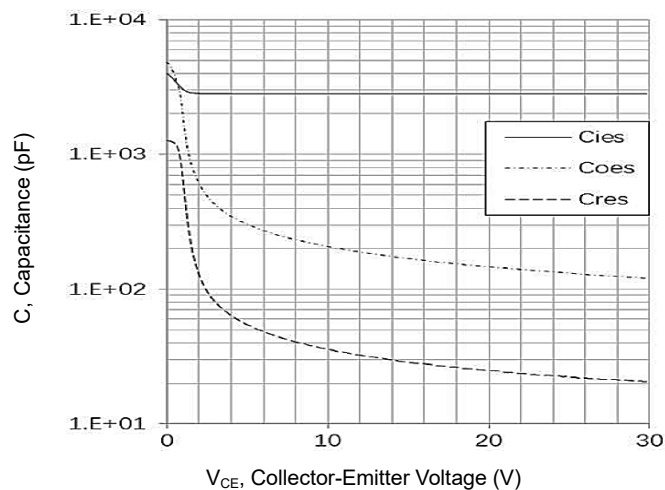
Switching Energy Loss vs Junction Temperature



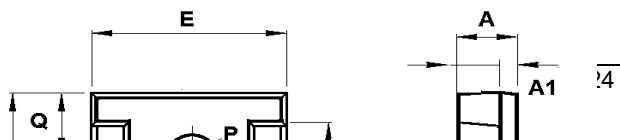
Switching Energy Loss vs Collector-Emitter Voltage



Typical Capacitance



DIMENSIONS



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Item	Min (mm)	Max (mm)
A	4.80	5.20
A1	1.85	2.15
A2	2.12	2.61
b	1.00	1.40
b1	2.80	3.20
c	0.50	0.70
D	20.70	21.30
D1	4.80	5.20
E	15.50	16.10
e	5.44 TYP	
e1	10.88 TYP	
L	19.62	20.22
L1	--	4.30
P	3.40	3.80
Q	6.15 TYP	