

Insulated Gate Bipolar Transistor

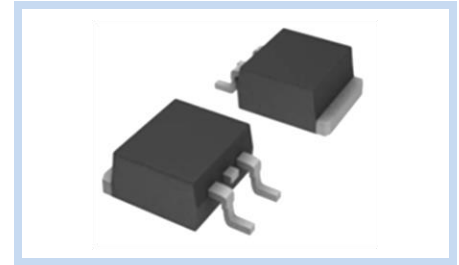
650V 40A 136W TO-263

MIG65N40T263

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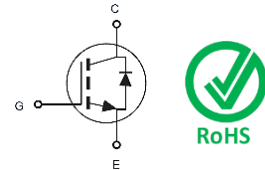
FEATURE

- Low Switching Losses
- Positive Temperature Coefficient
- High Ruggedness, Temperature Stable
- High Short Circuit Capability
- Applications: Soft Switching Applications, Air Conditioning, Motor Drive Inverter, High Frequency Inverters, UPS



MECHANICAL DATA

- Case: TO-263 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	40	A
	$T_C = 100^\circ\text{C}$		30	
Pulse Collector Current	tp limited by T_{Jmax} , $V_{GE} = 15\text{V}$	I_{CM}	60	A
Diode Forward Current – Continuous	$T_C = 25^\circ\text{C}$	I_F	40	A
	$T_C = 100^\circ\text{C}$		30	
Diode Forward Current – Pulsed		I_{FM}	60	A
Turn off Safe Operating Area	$V_{CE} \leq 650\text{V}$, $T_J \leq 150^\circ\text{C}$	-	60	A
Short Circuit Withstand Time	$V_{GE} = 15\text{V}$, $V_{CC} = 400\text{V}$, $V_{CEM} \leq 650\text{V}$	T_{SC}	5	μs
Power Dissipation	$T_J = 175^\circ\text{C}$	P_D	136	W
Thermal Resistance Junction to Case For Diode		$R_{\theta jc}$	1.8	$^\circ\text{C/W}$
Thermal Resistance Junction to Case For IGBT		$R_{\theta jc}$	1.1	$^\circ\text{C/W}$
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

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
	$V_{GE} = 0V, V_{CE}=650V, T_J=150^{\circ}C$		--	--	4	
Gate to Emitter Leakage Current	$V_{GE} = \pm 20V, V_{CE} = 0V$	I_{GES}	--	--	100	nA
Collector-Emitter Saturation Voltage	$V_{GE}=15V, I_C=30A$	$V_{CE(SAT)}$	--	1.65	1.95	V
	$V_{GE}=15V, I_C=30A, T_J=125^{\circ}C$		--	2.0	--	
	$V_{GE}=15V, I_C=30A, T_J=150^{\circ}C$		--	2.1	--	
Gate Threshold Voltage	$V_{CE}=V_{GE}, I_C=1mA$	$V_{GE(th)}$	4.7	5.5	6.2	V
Diode Forward Voltage	$I_F=30A$	V_F	--	1.6	2	V
	$I_F=30A, T_J=125^{\circ}C$		--	1.55	--	
	$I_F=30A, T_J=150^{\circ}C$		--	1.5	--	
Dynamic Characteristics	Conditions	Symbol	Min	Typ.	Max	Unit
Total Gate Charge	$V_{CC}=480V, V_{GE}=15V, I_C=30A$	Q_g	--	0.16	--	μC
Input Capacitance	$V_{CE}=25V, V_{GE}=0V, F=1MHz$	C_{ies}	--	1.53	--	nF
Reverse Transfer Capacitance		C_{res}	--	0.04	--	
Short Circuit Collector Current	$V_{CC}=400V, V_{GE}=15V, t_{SC} \leq 5\mu s, T_J \leq 150^{\circ}C$	$I_{C(SC)}$	--	130	--	A
Switching Characteristics	Conditions	Symbol	Min	Typ.	Max	Unit
Turn-On Delay Time	$V_{CC}=400V, V_{GE}=-5V \sim 15V, I_C=30A, R_G=20\Omega$	$T_{d(on)}$	--	58	--	ns
Rise Time		T_r	--	76	--	
Turn-Off Delay Time		$T_{d(off)}$	--	93	--	
Fall Time		T_f	--	88	--	
Turn-On Switching Loss		E_{on}	--	1.37	--	mJ
Turn-Off Switching Loss		E_{off}	--	0.63	--	
Turn-On Delay Time	$V_{CC}=400V, V_{GE}=-5V \sim 15V, I_C=30A, R_G=20\Omega, T_J=125^{\circ}C$	$T_{d(on)}$	--	56	--	ns
Rise Time		T_r	--	77	--	
Turn-Off Delay Time		$T_{d(off)}$	--	99	--	
Fall Time		T_f	--	116	--	
Turn-On Switching Loss		E_{on}	--	1.42	--	mJ
Turn-Off Switching Loss		E_{off}	--	0.79	--	
Turn-On Delay Time	$V_{CC}=400V, V_{GE}=-5V \sim 15V, I_C=30A, R_G=20\Omega, T_J=150^{\circ}C$	$T_{d(on)}$	--	54	--	ns
Rise Time		T_r	--	77	--	
Turn-Off Delay Time		$T_{d(off)}$	--	102	--	
Fall Time		T_f	--	128	--	
Turn-On Switching Loss		E_{on}	--	1.45	--	mJ
Turn-Off Switching Loss		E_{off}	--	0.85	--	
Diode Reverse Recovery Time	$I_F=30A, V_R=400V, di_F/dt = -320A/\mu s$	t_{rr}	--	114	--	ns
Reverse Recovery Charge		Q_{rr}	--	0.75	--	μC
Reverse Recovery Current		I_{rr}	--	11	--	A
Reverse Recovery Energy		E_{rec}	--	0.14	--	mJ
Diode Reverse Recovery Time	$I_F=30A, V_R=400V, di_F/dt = -320A/\mu s, T_J=125^{\circ}C$	t_{rr}	--	156	--	ns
Reverse Recovery Charge		Q_{rr}	--	1.14	--	μC
Reverse Recovery Current		I_{rr}	--	14	--	A
Reverse Recovery Energy		E_{rec}	--	0.27	--	mJ
Diode Reverse Recovery Time	$I_F=30A, V_R=400V, di_F/dt = -320A/\mu s, T_J=150^{\circ}C$	t_{rr}	--	177	--	ns
Reverse Recovery Charge		Q_{rr}	--	1.59	--	μC
Reverse Recovery Current		I_{rr}	--	16	--	A
Reverse Recovery Energy		E_{rec}	--	0.34	--	mJ

Note:

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

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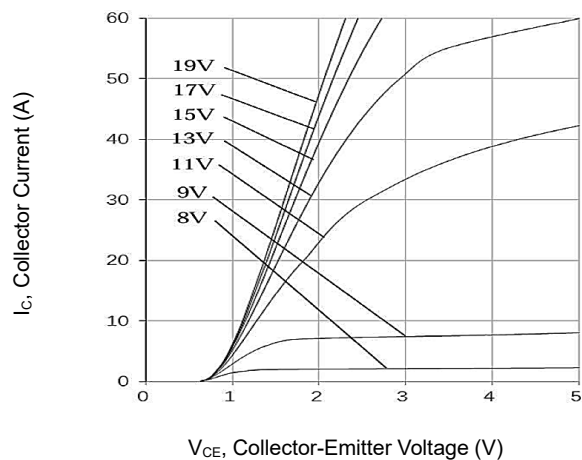
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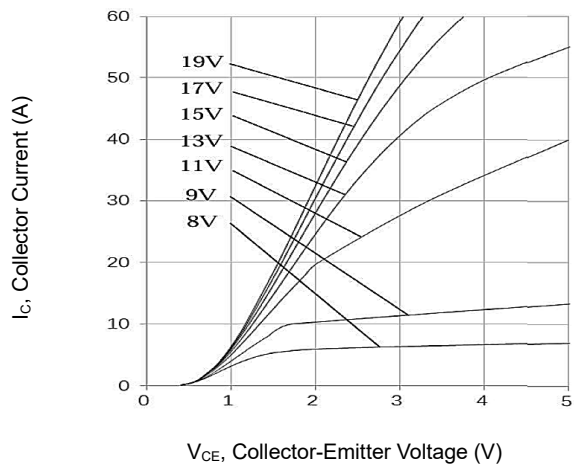
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CHARACTERISTIC CURVES

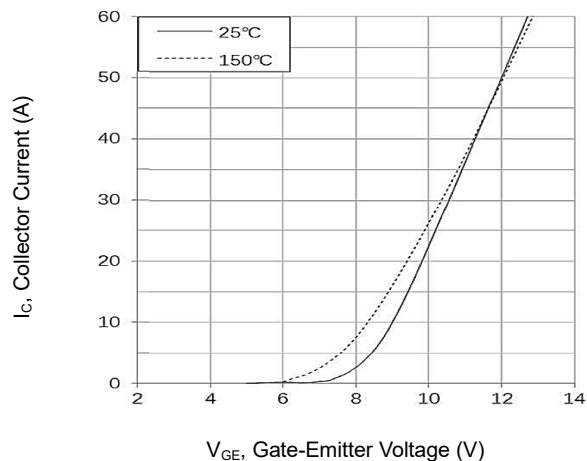
Output Characteristics($T_J=25^{\circ}\text{C}$)



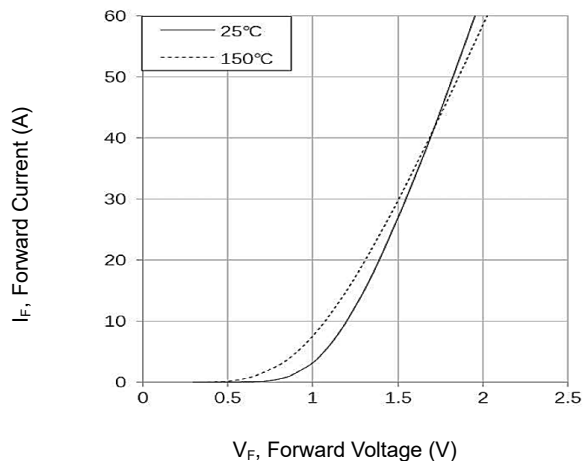
Output Characteristics($T_J=150^{\circ}\text{C}$)



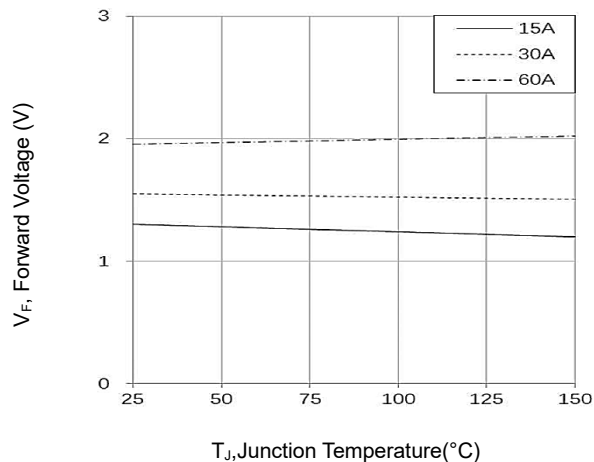
Transfer Characteristics



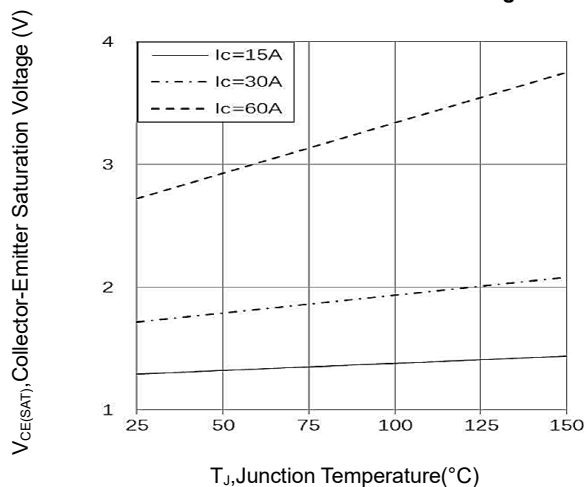
Diode Forward Characteristics



Diode Forward Voltage Variation



Collector-Emitter Saturation Voltage



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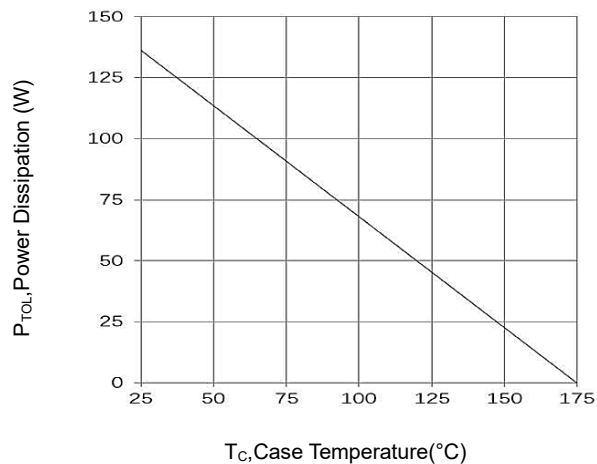
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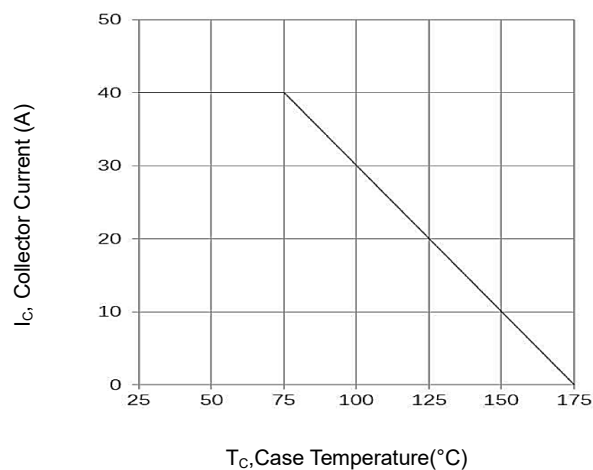
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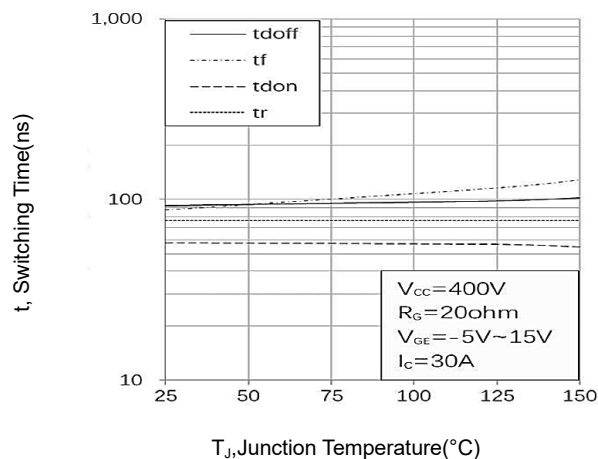
Power Dissipation



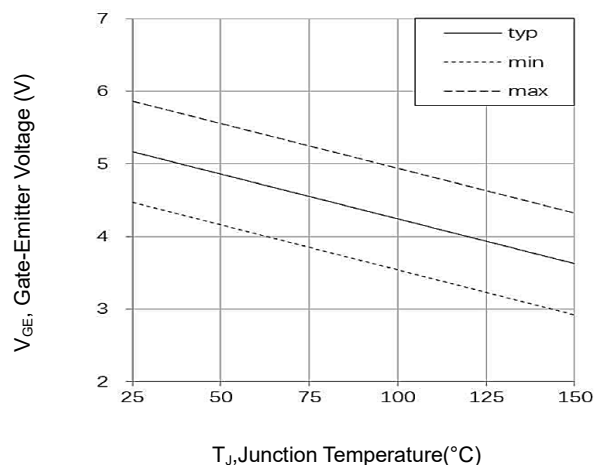
Collector Current



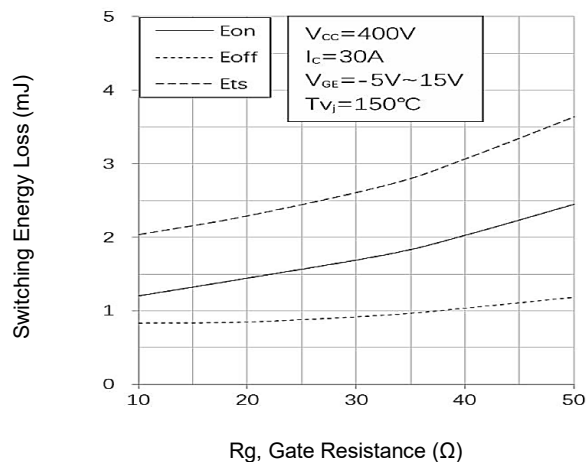
Switching Times vs Junction Temperature



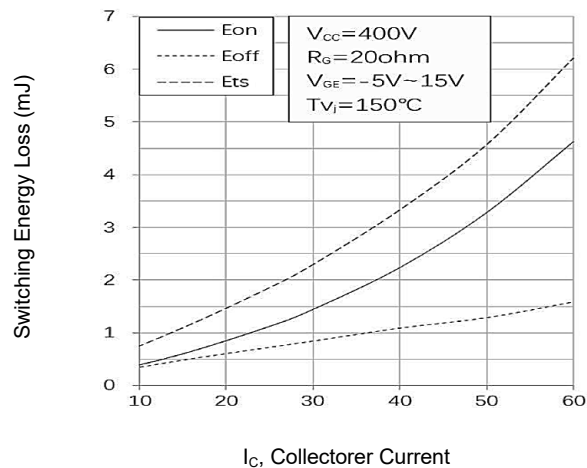
Gate-Emitter Voltage vs Junction Temperature



Switching Energy Loss vs Gate Resistances



Switching Energy Loss vs Collect Current



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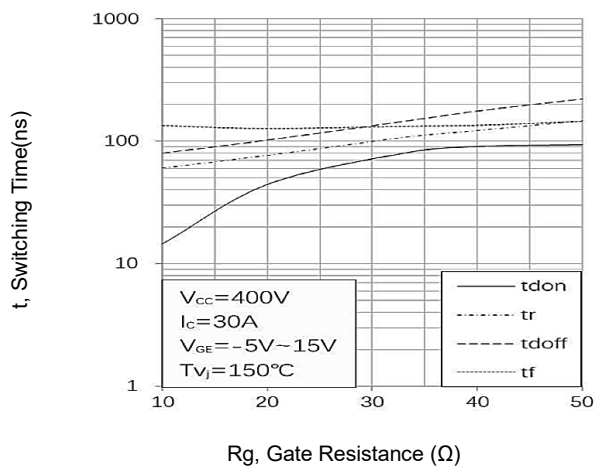
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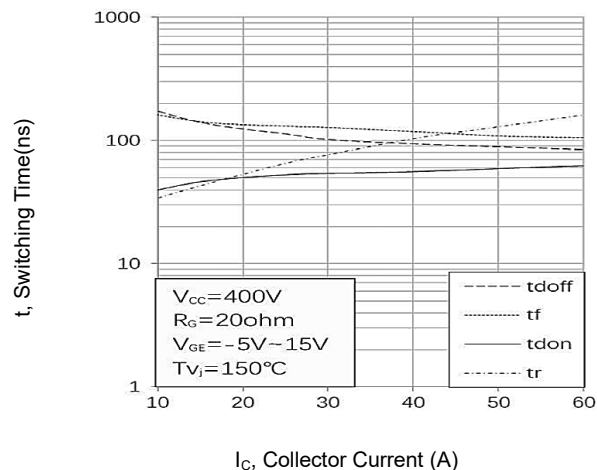
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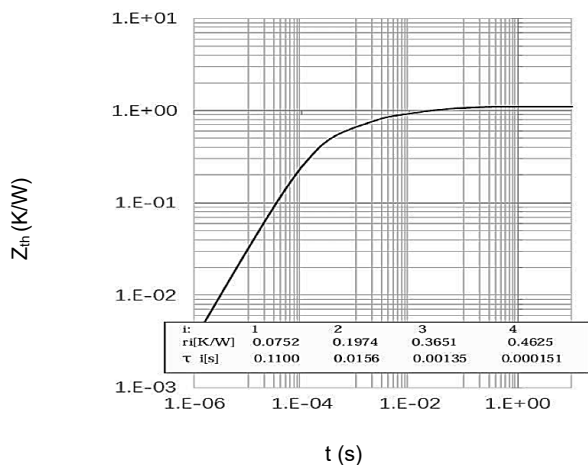
Switching Times vs Gate Resistances



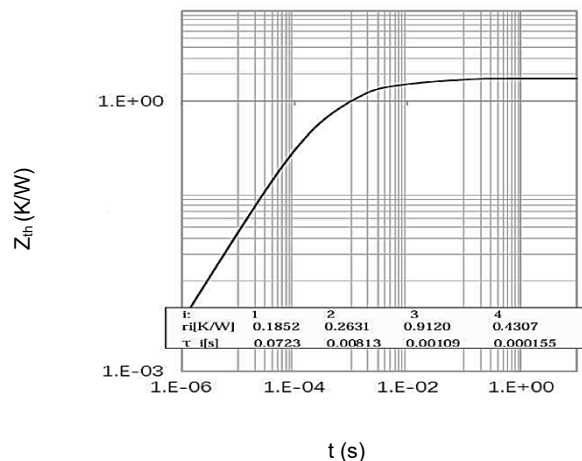
Switching Times vs Collect Current



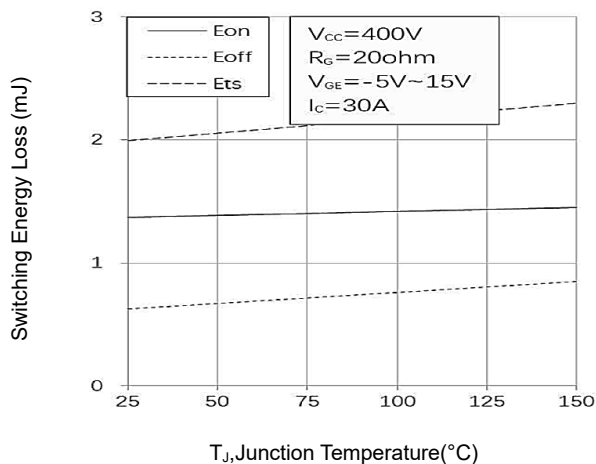
IGBT Transient Thermal Impedance



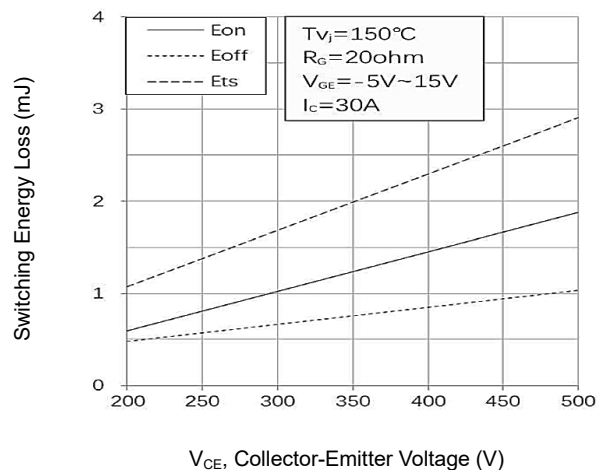
Diode Transient Thermal Impedance



Switching Energy Loss vs Junction Temperature



Switching Energy Loss vs Collector-Emitter Voltage



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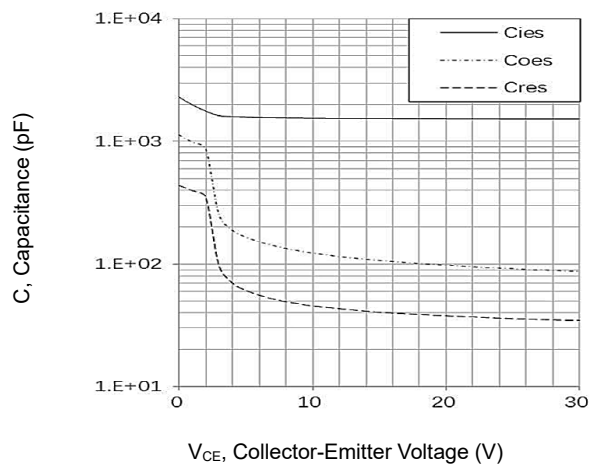
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CHARACTERISTIC CURVES

Collector-Emitter Voltage



DIMENSIONS

Item	Min (mm)	Max (mm)
A	4.04	5.10
A1	0.00	0.20
b	0.68	0.94
b2	1.17	1.75
c	0.28	0.24
c2	1.14	1.40
D	8.40	9.00
E	9.50	11.50
e	2.54 BSC	
H	14.60	16.55
L	1.78	2.79
L1	1.30	1.50
L2	1.50 REF	

Note: 1: Gate(G), 2: Collector(C), 3: Emitter (E).

