GTSM20N065

650-V Hybrid IGBT with Built-In SiC-SBD

Features

- High efficiency in hard switching and resonant topologies
- Easy paralleling capability due to positive temperature coefficient in VCE(on)
- Pb-free lead plating
- RoHS compliant

Benefits

- Low EMI
- Low Gate Charge QG
- Low Switching Loss & Soft Switching
- Built in No Recovery Silicon Carbide SBD
- Higher Switching Frequency up to 150kHz

Typical Applications

- Industrial UPS
- Charger
- Energy Storage
- Three-level Solar String Inverter
- Welding
- Inductive cooking
- Inverterized microwave ovens
- High power converters
- Soft switching applications

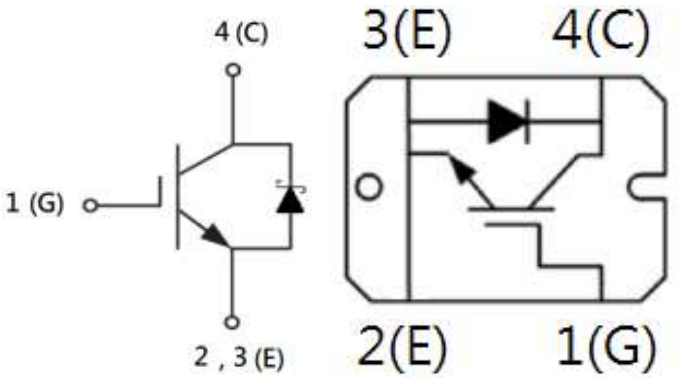
Package type：SOT-227

Packing & Order Information

100/Box

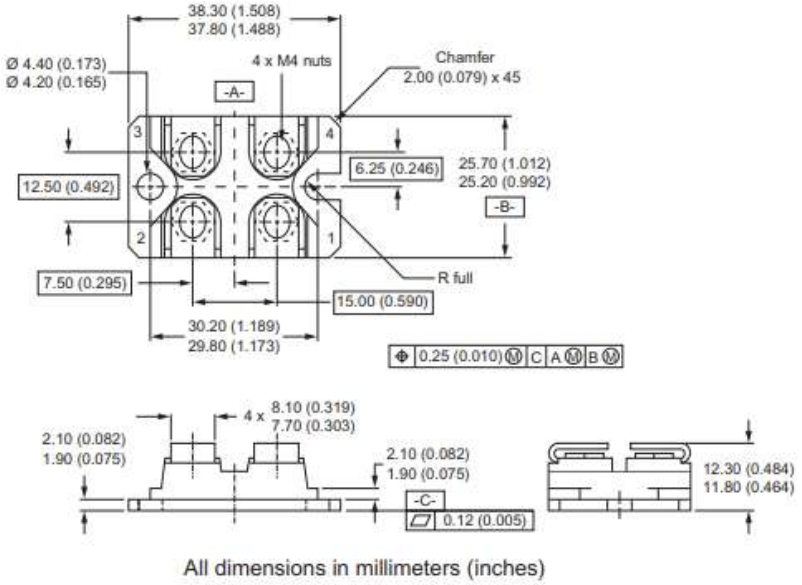
RoHS Compliant

Graphic Symbol



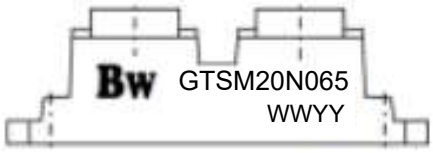
V_{CE}(on) typ. = 1.6V & R_{CE}(on) typ. = 80mΩ
@ V_{GE} = 15V, I_C = 20A
Equivalent MOSFET Parameters
R_{DS}(on) typ. = 80mΩ
@ V_{GS} = 15V, I_D = 20A

Package Dimension



All dimensions in millimeters (inches)

Marking



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MAXIMUM RATINGS AND ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings

Symbol	Parameter	Value	Units
V_{CE}	Collector-Emitter Voltage, Tvj ≥25°C	650	V
I_C	DC Collector current, Tc = 25°C	40	A
	DC Collector current, Tc = 100°C	20	
$I_{C\ pulse}$	Pulsed collector current, tp ≤ 1ms	80	A
I_F	Diode forward current, Tc = 25°C	20	A
	Diode forward current, Tc = 100°C	10	
$I_{F\ pulse}$	Diode pulsed current, tp ≤ 1ms	40	A
V_{GE}	Gate-Emitter voltage Transient Gate-Emitter voltage (tp ≤10μs, D < 0.010)	±20	V
P_{tot}	Power Dissipation (T_C =25°C)	137	W
T_{VJ}	Operating Junction Temperature	-55…175	°C
T_{STG}	Storage Temperature	-55…175	°C

Thermal Resistance Ratings

Symbol	Parameter	Maximum	Units
$R_{\theta JA}$	Maximum Junction-to-Ambient	0.32	°C/W
$R_{\theta JC}$	IGBT Maximum Junction-to-Case	0.8	°C/W
$R_{\theta JC}$	SBD Maximum Junction-to-Case	1.3	°C/W

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Static Electrical Characteristics, (T_{VJ}=25°C unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{GE\ (th)}$	Gate-emitter threshold voltage	V_{CE} =V_{GE}, I_C =250μA	5.0	5.8	6.5	V
$V_{(BR)CES}$	Collector-emitter breakdown voltage	V_{GE} =0V, I_C =500uA	650	-	-	V
$V_{CE(on)}$	Collector-Emitter saturation voltage	V_{GE} =15V, I_C =20A ,Tvj=25°C	-	1.6	2.0	V
		V_{GE} =15V, I_C =20A ,Tvj=150°C	-	1.75	2.2	
$R_{CE(on)}$	Collector-Emitter saturation resistor	V_{GE} =15V, I_C =20A ,Tvj=25°C	-	80	-	mΩ
		V_{GE} =15V, I_C =20A ,Tvj=150°C	-	88	-	
V_F	Diode Forward Voltage	V_{GE} =0V, I_F =10A Tvj=25°C	-	1.6	2.0	V
		V_{GE} =0V, I_F =10A Tvj= 125°C	-	1.4	-	
I_{GES}	Gate-Emitter leakage current	V_{CE} =0V, V_{GE} =±20V	-	-	±200	nA
I_{CES}	Zero gate voltage collector current	V_{CE} =650V, V_{GE} =0V Tvj=25°C	-	-	25	uA
		V_{CE} =650V, V_{GE} =0V Tvj=175°C	-	-	250	

IGBT AC Electrical Characteristics, (T_{VJ}=25°C unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
C_{IES}	Input Capacitance	V_{CE}=25 V, V_{GE}=0 V, f=1MHz	-	1500	-	pF
C_{OES}	Output Capacitance		-	128	-	
C_{RES}	Reverse Transfer Capacitance		-	28.7	-	
Q_g	Total Gate Charge	V_{CC}=400 V_{GE}=15V, I_C =20A	-	43.9	-	nC
$t_{d(on)}$	Turn-On Delay Time	V_{CE}=400 V, V_{GE}=15V, I_C =20A R_{Gon} = 10Ω	-	16	-	ns
t_r	Rise Time		-	56	-	
$t_{d(off)}$	Turn-Off Delay Time		-	52	-	
t_f	Fall Time		-	82	-	
E_{on}	Turn-On Switching Energy		-	0.79	-	mJ
E_{off}	Turn-Off Switching Energy		-	0.3	-	

Diode AC Electrical Characteristics, (T_{VJ}=25°C unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
I_{rrm}	Diode peak reverse recovery current	V_{CE}=400 V, V_{GE}=0V, I_F = 10A, dIEC/dt=100A/μs	-	2.7	-	A
Q_{rr}	Diode reverse recovery Charge		-	33	-	nC
t_{rr}	Diode reverse recovery time		-	26	-	ns

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- **Typical Electrical Characteristics**

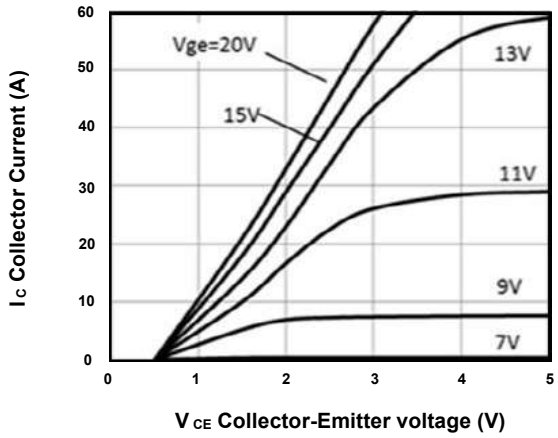

FIG.1-Output Characteristics Tvj = 25°C

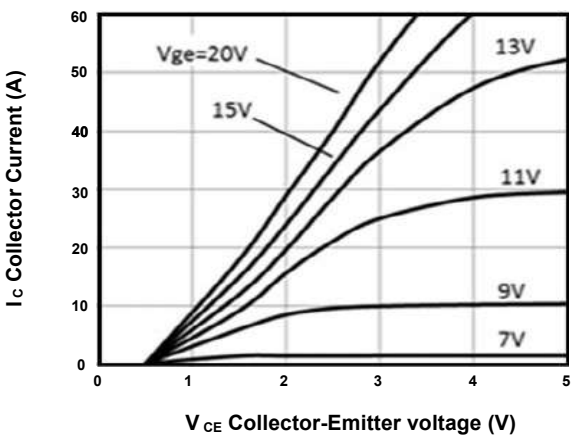

FIG.2- Output Characteristics Tvj = 175°C

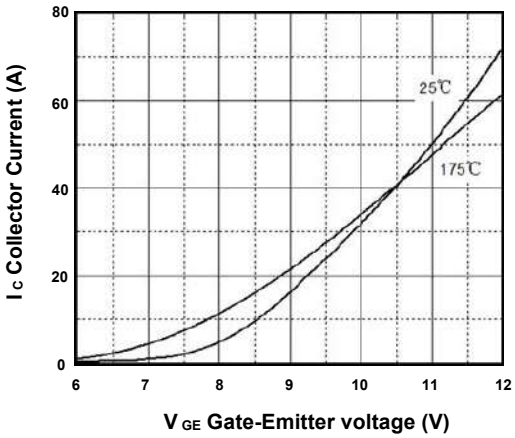

FIG.3- Transfer Characteristics

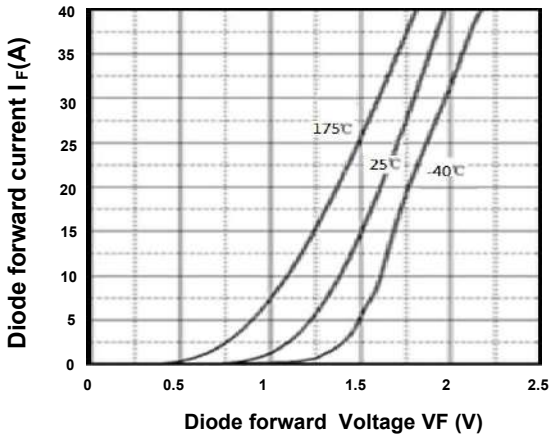

FIG.4- Diode forward Characteristics

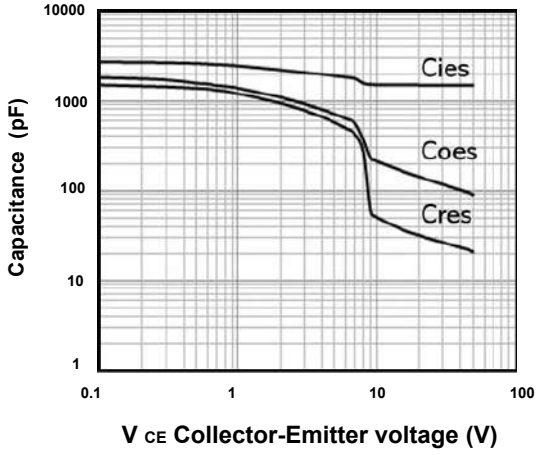

FIG.5- Capacitance

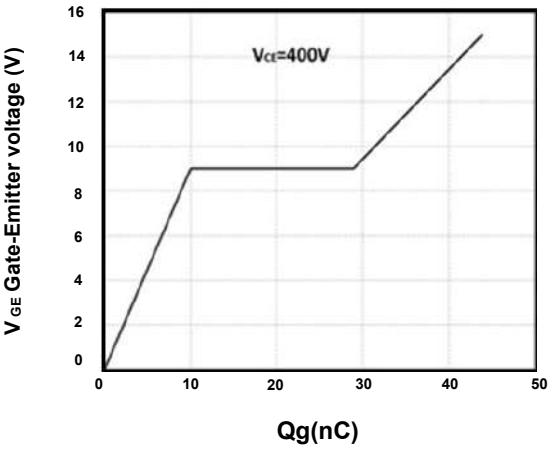

Fig.6- Gate-Charge Characteristics

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- **Typical Electrical Characteristics**

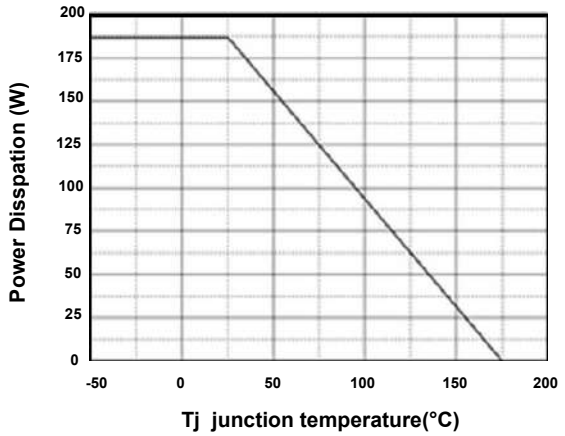

FIG.7- Power Disspation vs Junction Temperature

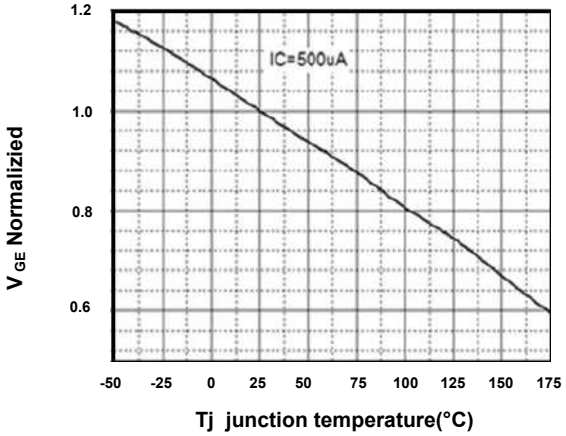

FIG.8- V_{GE} Normalized vs Junction temperature

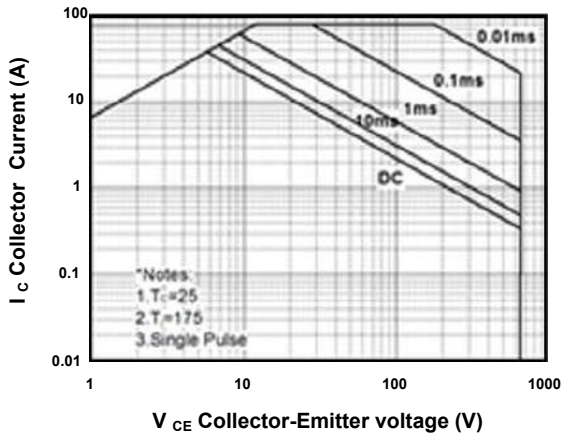

FIG.9- Safe Operation Area

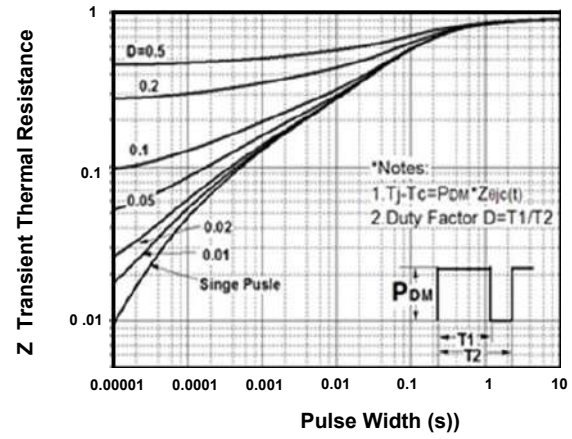

FIG.10- Transient Thermal Impedance for IGBT

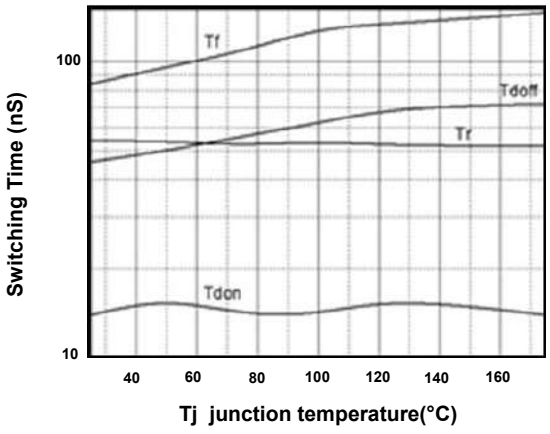

FIG.11- Switching Time vs Junction Temperature

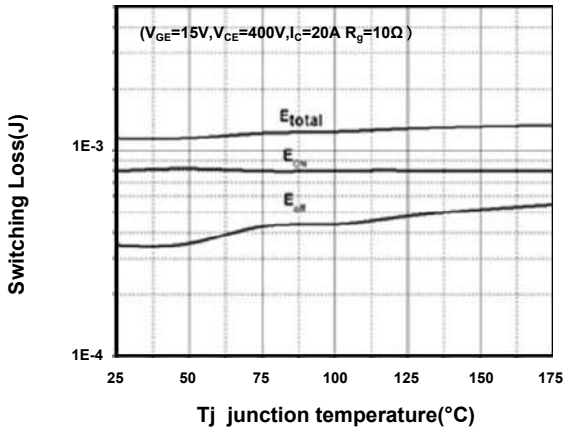

FIG.12- Switching Loss vs Junction Temperature

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