

GTSM40N065D

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 $V_{CE(on)}$
- 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

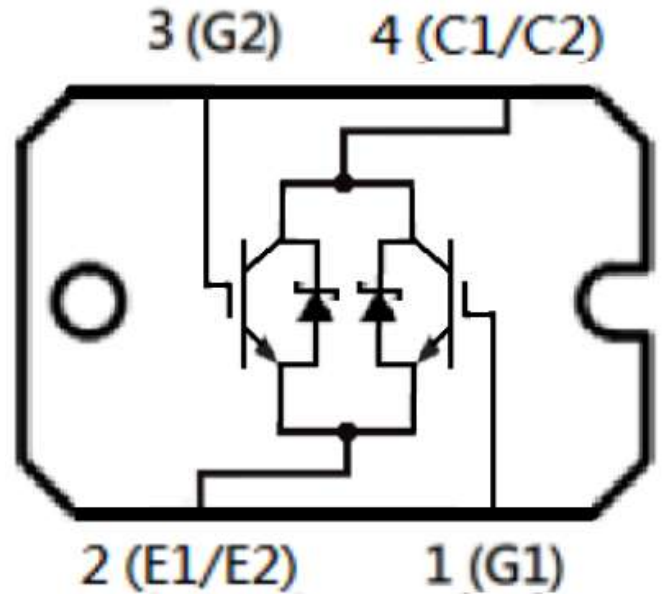
Packing & Order Information

100/Box



RoHS Compliant

Graphic Symbol



$V_{CE(on)}$ typ. = 1.6V & $R_{CE(on)}$ typ. = 40m Ω

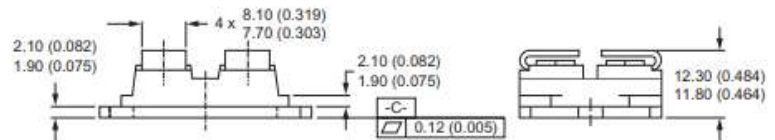
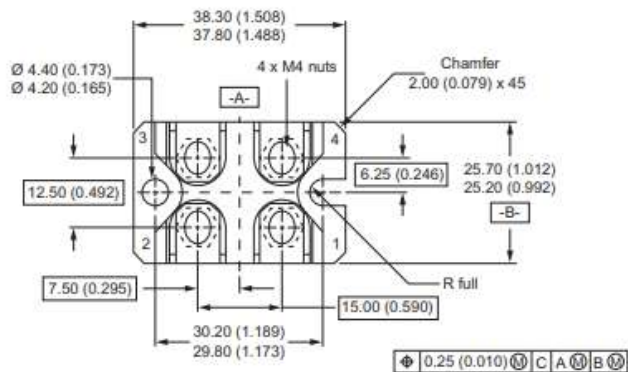
@ V_{GE} = 15V, I_C = 40A

Equivalent MOSFET Parameters

$R_{DS(on)}$ typ. = 40m Ω

@ V_{GS} = 15V, I_D = 40A

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, $T_{vj} \geq 25^{\circ}\text{C}$	650	V
I_C	DC Collector current, $T_c = 25^{\circ}\text{C}$	60	A
	DC Collector current, $T_c = 100^{\circ}\text{C}$	40	
$I_{C\text{ pulse}}$	Pulsed collector current, $t_p \leq 1\text{ms}$	140	A
I_F	Diode forward current, $T_c = 25^{\circ}\text{C}$	40	A
	Diode forward current, $T_c = 100^{\circ}\text{C}$	20	
$I_{F\text{ pulse}}$	Diode pulsed current, $t_p \leq 1\text{ms}$	80	A
V_{GE}	Gate-Emitter voltage Transient Gate-Emitter voltage ($t_p \leq 10\mu\text{s}$, $D < 0.010$)	± 20	V
P_{tot}	Power Dissipation ($T_c = 25^{\circ}\text{C}$)	260	W
T_{vj}	Operating Junction Temperature	$-55 \dots 175$	$^{\circ}\text{C}$
T_{stg}	Storage Temperature	$-55 \dots 175$	$^{\circ}\text{C}$

Thermal Resistance Ratings			
Symbol	Parameter	Maximum	Units
$R_{\theta JA}$	Maximum Junction-to-Ambient	0.32	$^{\circ}\text{C/W}$
$R_{\theta JC}$	IGBT Maximum Junction-to-Case	0.8	$^{\circ}\text{C/W}$
$R_{\theta JC}$	SBD Maximum Junction-to-Case	1.3	$^{\circ}\text{C/W}$

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Static Electrical Characteristics, ($T_{VJ}=25^{\circ}\text{C}$ unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{GE(th)}$	Gate-emitter threshold voltage	$V_{CE}=V_{GE}$, $I_C=250\mu\text{A}$	5.0	5.8	6.5	V
$V_{(BR)CES}$	Collector-emitter breakdown voltage	$V_{GE}=0\text{V}$, $I_C=500\mu\text{A}$	650	-	-	V
$V_{CE(on)}$	Collector-Emitter saturation voltage	$V_{GE}=15\text{V}$, $I_C=40\text{A}$, $T_{VJ}=25^{\circ}\text{C}$	-	1.6	2.0	V
		$V_{GE}=15\text{V}$, $I_C=40\text{A}$, $T_{VJ}=150^{\circ}\text{C}$	-	1.75	2.2	
$R_{CE(on)}$	Collector-Emitter saturation resistor	$V_{GE}=15\text{V}$, $I_C=40\text{A}$, $T_{VJ}=25^{\circ}\text{C}$	-	40	-	$\text{m}\Omega$
		$V_{GE}=15\text{V}$, $I_C=40\text{A}$, $T_{VJ}=150^{\circ}\text{C}$	-	44	-	
V_F	Diode Forward Voltage	$V_{GE}=0\text{V}$, $I_F=20\text{A}$, $T_{VJ}=25^{\circ}\text{C}$	-	1.6	2.0	V
		$V_{GE}=0\text{V}$, $I_F=20\text{A}$, $T_{VJ}=125^{\circ}\text{C}$	-	1.4	-	
I_{GES}	Gate-Emitter leakage current	$V_{CE}=0\text{V}$, $V_{GE}=\pm 20\text{V}$	-	-	± 200	nA
I_{CES}	Zero gate voltage collector current	$V_{CE}=650\text{V}$, $V_{GE}=0\text{V}$, $T_{VJ}=25^{\circ}\text{C}$	-	-	50	μA
		$V_{CE}=650\text{V}$, $V_{GE}=0\text{V}$, $T_{VJ}=150^{\circ}\text{C}$	-	80	-	

IGBT AC Electrical Characteristics, ($T_{VJ}=25^{\circ}\text{C}$ unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
C_{IES}	Input Capacitance	$V_{CE}=25\text{V}$, $V_{GE}=0\text{V}$, $f=1\text{MHz}$	-	3000	-	pF
C_{OES}	Output Capacitance		-	250	-	
C_{RES}	Reverse Transfer Capacitance		-	55	-	
Q_g	Total Gate Charge	$V_{CC}=400\text{V}$, $V_{GE}=15\text{V}$, $I_C=40\text{A}$	-	110	-	nC
$t_{d(on)}$	Turn-On Delay Time	$V_{CE}=400\text{V}$, $V_{GE}=15\text{V}$, $I_C=40\text{A}$, $R_{Gon}=10\Omega$	-	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	-	

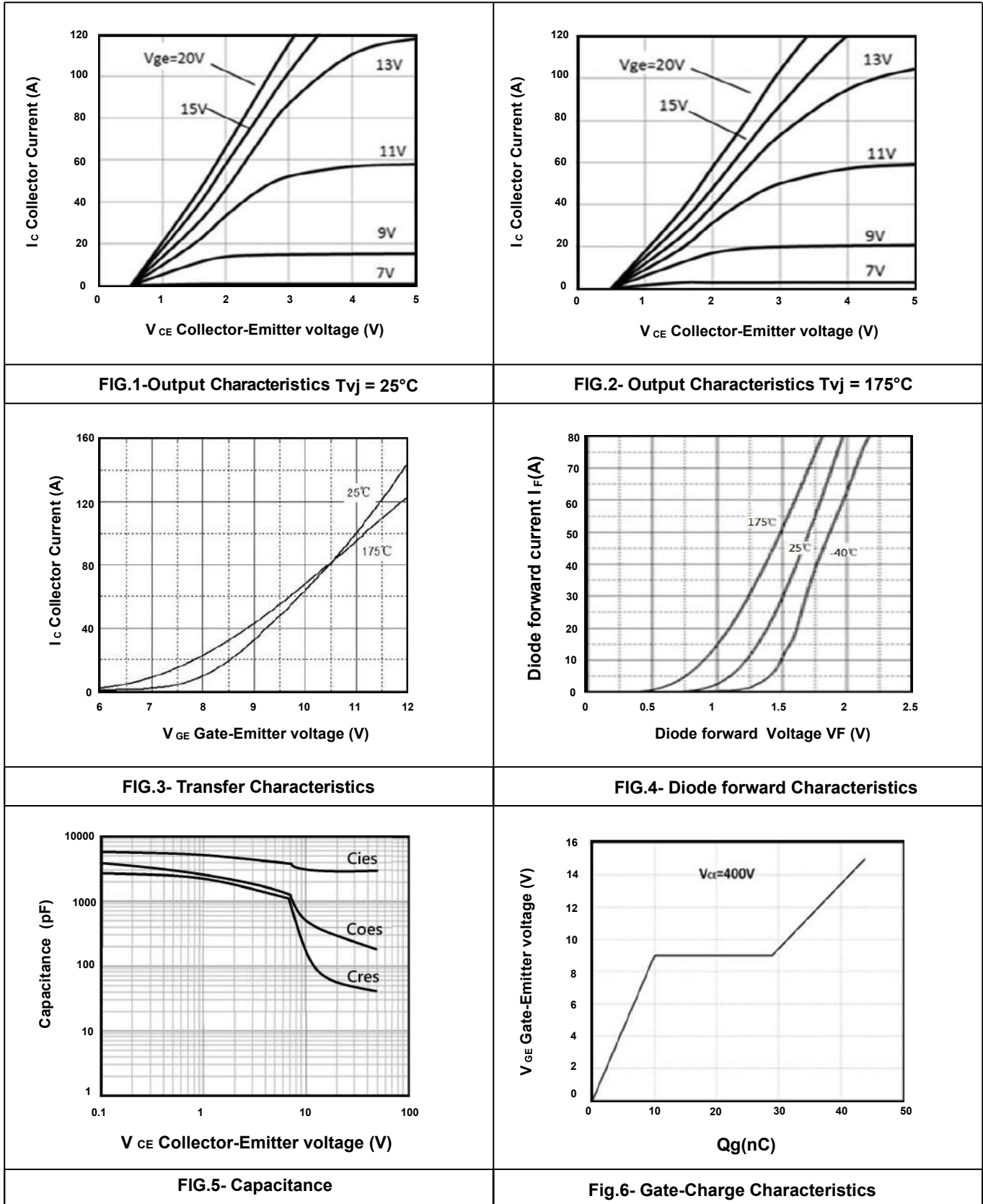
Diode AC Electrical Characteristics, ($T_{VJ}=25^{\circ}\text{C}$ unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
I_{rrm}	Diode peak reverse recovery current	$V_{CE}=400\text{V}$, $V_{GE}=0\text{V}$, $I_F=20\text{A}$, $dI_{EC}/dt=100\text{A}/\mu\text{s}$	-	5.4	-	A
Q_{rr}	Diode reverse recovery Charge		-	73	-	nC
t_{rr}	Diode reverse recovery time		-	26	-	ns

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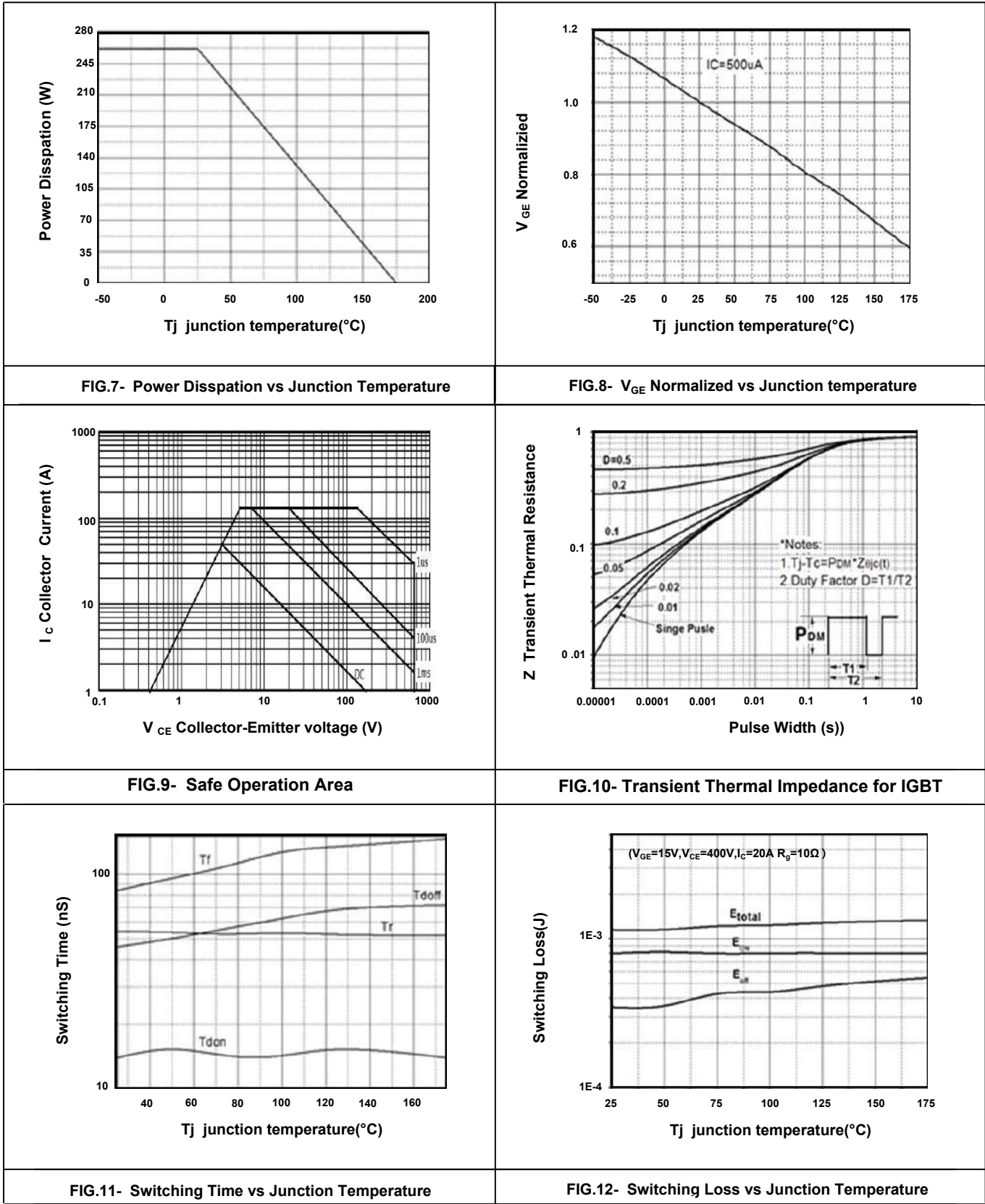
• Typical Electrical Characteristics



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• Typical Electrical Characteristics



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