

■ Applications

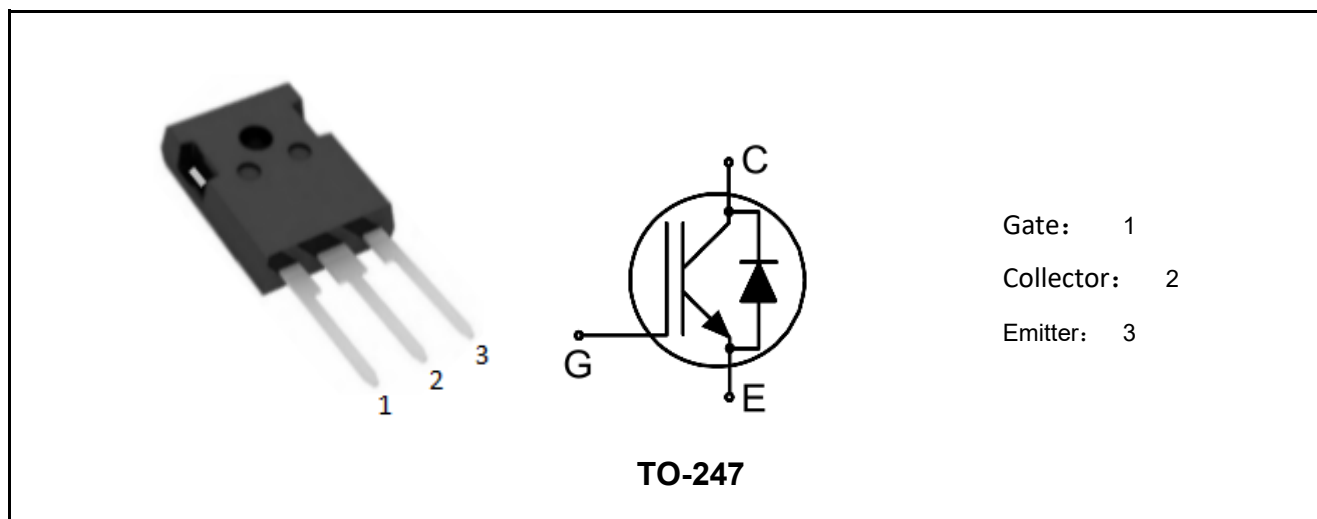
- Industrial UPS
- Welding machine
- Solar converters
- Energy Storage
- Mid to high range switching frequency converters

■ Features

- Low switching power loss
- Low switching surge and noise
- Advanced Fieldstop technology
- Low $V_{CE(sat)}$
- Short circuit withstand time – 8 μ S
- Qualified according to JEDEC for target applications
- RoHS and Halogen-Free Compliant

■ Product Summary

V_{CES}	650	V
I_C	20	A
$V_{CE(sat)}, Typ @ 15V$	1.7	V



Marking	Package	Packaging	Min. package quantity
MSB20N065T3H	TO-247	Tube	450



■ Absolute Maximum Ratings (Tc=25°C unless otherwise noted)

Parameter	Symbol	Ratings	Unit
Collector-emitter Voltage	V_{CES}	650	V
DC collector current, limited by T_{jmax} TC=25°C TC=100°C	I_C	40 20	A
Pulsed collector current, tp limited by T_{jmax}	$I_{C\ Pulse}$	80	A
Diode forward current, limited by T_{jmax} TC=25°C TC=100°C	I_F	40 20	A
Diode Pulsed current, tp limited by T_{jmax}	$I_{F\ Pulse}$	80	A
Continuous Gate-emitter voltage	V_{GE}	±20	V
Short circuit withstand time $V_{GE}=15V, V_{CC} \leq 400V, T_J \leq 150^\circ C$	t_{SC}	8	μs
Power Dissipation (TC=25°C)	P_D	170	W
Junction Temperature	T_J	150	°C
Storage Temperature	T_{STG}	-55-150	°C

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings.

■ Thermal Characteristics

Parameter	Symbol	Max	Unit
IGBT Maximum Junction-to-Case	$R_{\theta JC}$	0.72	°C/W
Diode Maximum Junction-to-Case	$R_{\theta JC}$	2	°C/W
Maximum Junction-to-Ambient	$R_{\theta JA}$	60	°C/W

Note: This transistor is sensitive to electrostatic discharge and should be handled with care.



■ Electrical Characteristics (Tc=25°C unless otherwise noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Static Characteristics						
Collector-emitter breakdown voltage	BV_{CES}	$V_{GE}=0V, I_C=250\mu A$	650	-	-	V
Zero gate voltage collector current	I_{CES}	$V_{CE}=650V, V_{GE}=0V$	-	-	1	μA
Gate-emitter leakage current	I_{GES}	$V_{GE}=\pm 20V, V_{CE}=0V$	-	-	± 200	nA
Gate-emitter threshold voltage	$V_{GE(TH)}$	$V_{CE}=V_{GE}, I_C=250\mu A$	4	5.4	6	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	$V_{GE}=15V, I_C=20A$	-	1.65	2.1	V
			$T_J=125^{\circ}C$	-	2	-
Diode forward voltage	V_F	$I_F=20A$	-	1.5	1.8	V
			$T_J=150^{\circ}C$	-	1.1	-
Dynamic Characteristics						
Input Capacitance	C_{ies}	$V_{CE}=25V, V_{GE}=0V, f=1.0MHz$	-	1136	-	pF
Output Capacitance	C_{oes}		-	76	-	pF
Reverse Transfer Capacitance	C_{res}		-	24	-	pF
Integrated gate resistor	R_{Gint}		-	1.5	-	Ω
Total Gate Charge	Q_g	$V_{CC}=50V, I_C=20A, V_{GE}=15V$	-	41	-	nC
Gate-to-emitter charge	Q_{ge}		-	12	-	nC
Gate-to-collector charge	Q_{gc}		-	16	-	nC
Internal emitter inductance measured 5mm (0.197 in.) from case	L_E		-	8	-	nH





■ Switching Characteristic, Inductive Load, at $T_j=25^\circ\text{C}$

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
IGBT Switching Characteristics						
Turn-On Delay Time	t _{d(on)}	V _{CC} =400V,I _C =20A, V _{GE} =15V,R _g =10Ω Inductive load	-	19	-	ns
Turn-On Rise Time	t _r		-	55	-	ns
Turn-Off Delay Time	t _{d(off)}		-	50	-	ns
Turn-Off Fall Time	t _f		-	115	-	ns
Turn-on energy	E _{on}		-	1	-	mJ
Turn-off energy	E _{off}		-	0.3	-	mJ
Body Diode Characteristics						
Reverse Recovery Time	t _{rr}	V _R =400V,I _F =30A, di/dt=200A/us	-	70	-	ns
Reverse Recovery Charge	Q _{rr}		-	0.28	-	μC
Peak Reverse Recovery Current	I _{rrm}		-	8	-	A

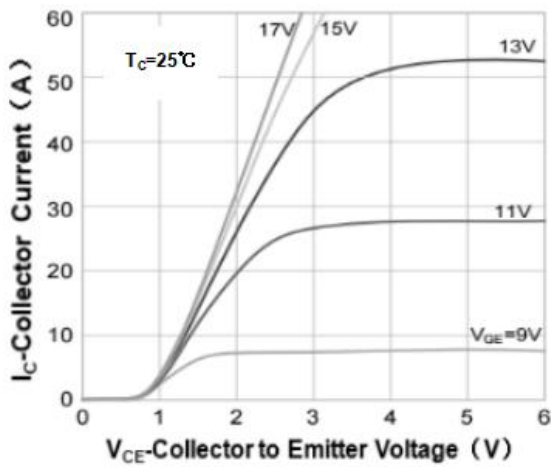
■ Switching Characteristic, Inductive Load, at $T_j=150^\circ\text{C}$

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
IGBT Switching Characteristics						
Turn-On Delay Time	t _{d(on)}	V _{CC} =400V,I _C =20A, V _{GE} =15V,R _g =10Ω Inductive load	-	20	-	ns
Turn-On Rise Time	t _r		-	54	-	ns
Turn-Off Delay Time	t _{d(off)}		-	49	-	ns
Turn-Off Fall Time	t _f		-	119	-	ns
Turn-on energy	E _{on}		-	1.5	-	mJ
Turn-off energy	E _{off}		-	0.55	-	mJ
Diode Characteristics						
Reverse Recovery Time	t _{rr}	V _R =400V,I _F =30A, di/dt=200A/us	-	110	-	ns
Reverse Recovery Charge	Q _{rr}		-	0.56	-	μC
Peak Reverse Recovery Current	I _{rrm}		-	10.2	-	A

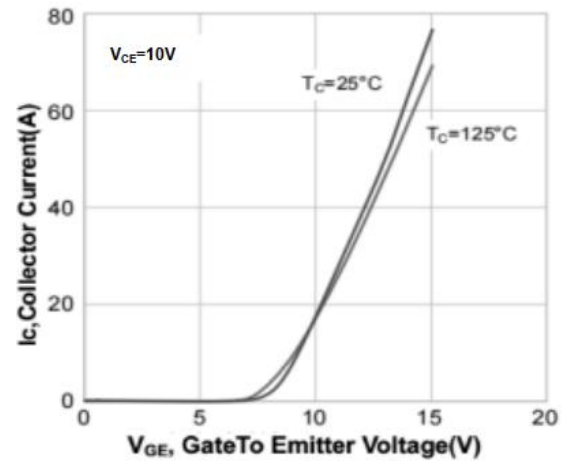




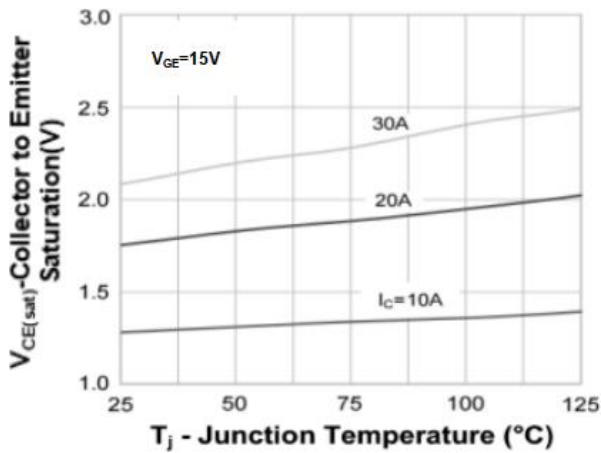
■ Characteristics Curves



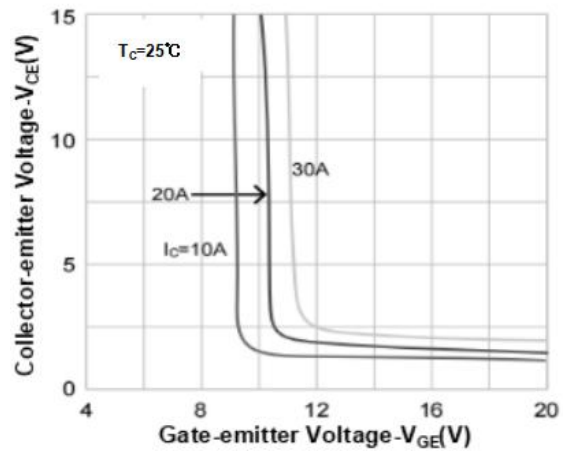
Output Characteristics



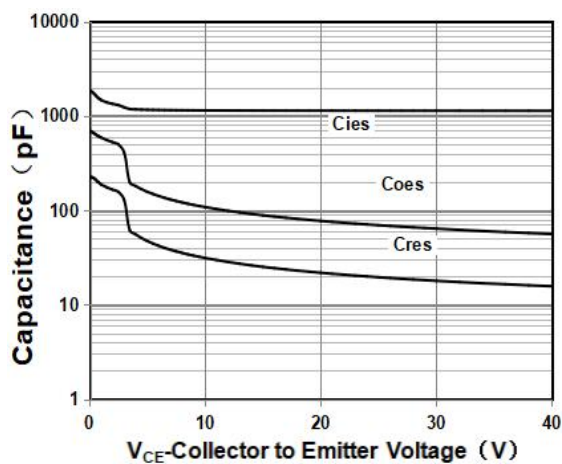
Transfer Characteristics



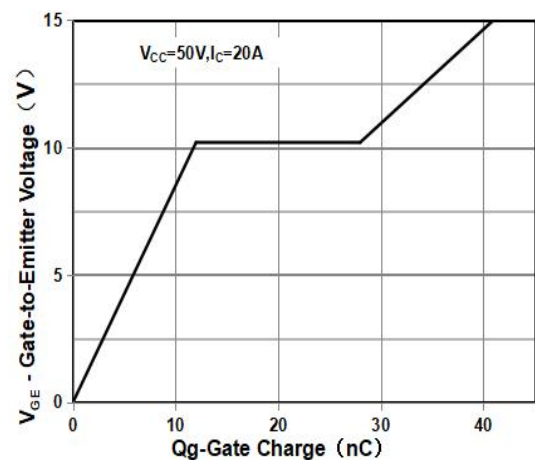
Typical collector-emitter saturation voltage as a function of junction temperature



Saturation voltage vs. V_{GE}

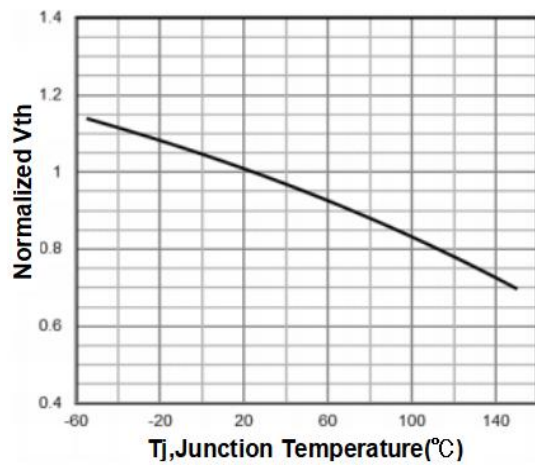


Capacitance

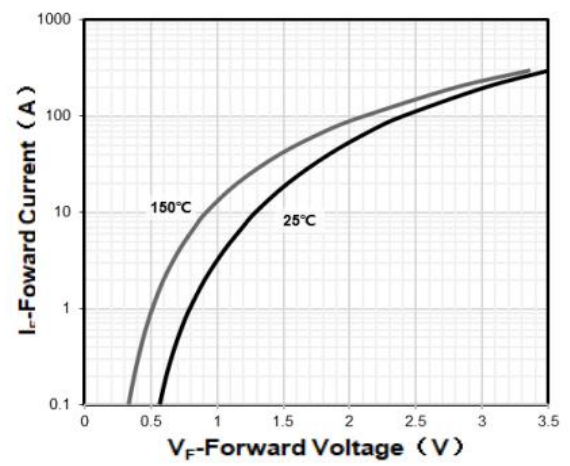


Typical gate charge





Gate-emitter threshold voltage as a function of junction temperature



Typ. diode forward current as a function of forward voltage

Note : The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.



**■ TO-247 Package Dimensions**

Unit: mm

Symbol	Min	Nom	Max	Symbol	Min	Nom	Max
A	4.60		5.15	A1	1.30		1.60
b	2.86		3.26	b1	1.86		2.26
b2		1.20		C		0.50	
D	19.00		21.00	E	15.45		15.75
E1	12.00		13.06	e		5.45	
L	14.00		14.60	L1	5.20		5.88
L2	24.00		24.40	L3	10.00		10.60
ΦP		3.50		Q	2.30		2.70

