

650V 160A CoolFAST™ 7 Technology IGBT

Part No.: HMG160N65FT3

Package: TO-247Plus-3L

Features:

- Low Switching Power Loss
- Low Switching Surge and Noise
- Advanced Field Stop Technology
- Low EMI
- Maximum Junction Temperature 175°C
- Qualified According to JEDEC For Target Applications
- Pb-free Lead Plating, Halogen-free Mold Compound, RoHS Compliant

Applications:

- Industrial UPS
- Welding Machine
- String Inverters
- Energy Storage
- EV Charger



Key Performance and Package Parameters

Type	Vce	Ic	VCESat,Tvj=25°C	Tvjmax	Marking	Package
HMG160N65FT3	650V	160A	1.7V	175°C	HMG160N65FT3	TO-247Plus-3L

Maximum Ratings and Characteristics

Absolute Maximum Ratings at Tvj= 25°C (unless otherwise specified)

Items	Symbols	Value	Units
Collector-emitter voltage	V _{CES}	650	V
Gate-emitter voltage	V _{GES}	±20	V
Transient gate-emitter voltage (t _p ≤ 10μs, D < 0.010)		±30	V
DC collector current, limited by T _{vjmax} T _C = 25°C T _C = 100°C	I _C	160 160	A
Pulsed collector current, t _p limited by T _{vjmax}	I _{CP}	640	A
Diode forward current, limited by T _{vjmax} T _C = 25°C T _C = 100°C	I _F	120 60	A
Diode Pulsed collector current, t _p limited by T _{vjmax}	I _{FP}	240	A
Short circuit withstand time, V _{GE} = 15V, V _{CE} ≤ 400V	T _{SC}	5	μs
Operating junction temperature	T _{vj}	-40 ~ +175	°C
Storage temperature	T _{stg}	-55 ~ +175	°C

Electrical Characteristics at $T_{vj} = 25^{\circ}\text{C}$ (unless otherwise specified)

Description	Symbols	Conditions	Characteristics			Unit
			Min	Typ	Max	
Collector-emitter breakdown voltage	$V_{(BR)CES}$	$V_{GE} = 0\text{V}$, $I_C = 0.50\text{mA}$	650	-	-	V
Zero gate voltage collector current	I_{CES}	$V_{CE} = 650\text{V}$, $V_{GE} = 0\text{V}$	-	-	200	μA
Gate-emitter leakage current	I_{GES}	$V_{CE} = 0\text{V}$, $V_{GE} = \pm 20\text{V}$	-	-	± 200	nA
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$, $I_C = 250\mu\text{A}$	5.0	5.4	5.8	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	$V_{GE} = 15\text{V}$, $I_C = 160\text{A}$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	-	1.7	2.2	V
			-	2.1	-	
Input capacitance	C_{ies}	$V_{CE} = 25\text{V}$, $V_{GE} = 0\text{V}$ $f = 1\text{MHz}$	-	17800	-	pF
Output capacitance	C_{oes}		-	228	-	pF
Reverse transfer capacitance	C_{res}		-	60	-	pF
Gate charge	Q_G	$V_{CC} = 520\text{V}$, $I_C = 160\text{A}$, $V_{GE} = 15\text{V}$	-	666	-	nC
Forward voltage drop	V_F	$I_F = 160\text{A}$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	-	2.5	3.0	V
			-	2.0	-	

Switching Characteristics at $T_{vj} = 25^{\circ}\text{C}$

Description	Symbols	Conditions	Characteristics			Unit
			Min	Typ	Max	
IGBT Characteristics						
Turn-on delay time	$t_{d(on)}$	$V_{CC}= 400V$ $I_C= 160A$ $V_{GE}= 15V$ $R_G= 10\Omega$ Inductive load	-	170	-	ns
Rise time	t_r		-	114	-	ns
Turn-off delay time	$t_{d(off)}$		-	435	-	ns
Fall time	t_f		-	114	-	ns
Turn-on energy	E_{on}		-	4.5	-	mJ
Turn-off energy	E_{off}		-	4.6	-	mJ
Total switching energy	E_{ts}		-	9.1	-	mJ
Diode Characteristics						
Diode reverse recovery time	t_{rr}	$V_{CC}= 400V$	-	75	-	ns
Diode reverse recovery charge	Q_{rr}	$I_F= 160A$	-	0.6	-	μC
Diode peak reverse recovery current	I_{rrm}	$di_F/dt= 1000A/\mu s$	-	20	-	A

Switching Characteristics at $T_{vj} = 175^{\circ}\text{C}$

Description	Symbols	Conditions	Characteristics			Unit
			Min	Typ	Max	
IGBT Characteristics						
Turn-on delay time	$t_{d(on)}$	$V_{CC}= 400V$ $I_C= 160A$ $V_{GE}= 15V$ $R_G= 10\Omega$ Inductive load	-	154	-	ns
Rise time	t_r		-	111	-	ns
Turn-off delay time	$t_{d(off)}$		-	475	-	ns
Fall time	t_f		-	121	-	ns
Turn-on energy	E_{on}		-	6.1	-	mJ
Turn-off energy	E_{off}		-	5.6	-	mJ
Total switching energy	E_{ts}		-	11.7	-	mJ
Diode Characteristics						
Diode reverse recovery time	t_{rr}	$V_{CC}= 400V$	-	224	-	ns
Diode reverse recovery charge	Q_{rr}	$I_F= 160A$	-	5.7	-	μC
Diode peak reverse recovery current	I_{rrm}	$di_F/dt= 1200A/\mu s$	-	46	-	A

Thermal Resistance

Items	Symbols	Characteristics			Unit
		Min	Typ	Max	
Thermal resistance, junction-ambient	$R_{\theta JA}$	-	-	50	°C /W
Thermal resistance, IGBT junction to case	$R_{\theta JC}$	-	-	0.28	
Thermal resistance, diodes junction to case	$R_{\theta JC}$	-	-	0.3	

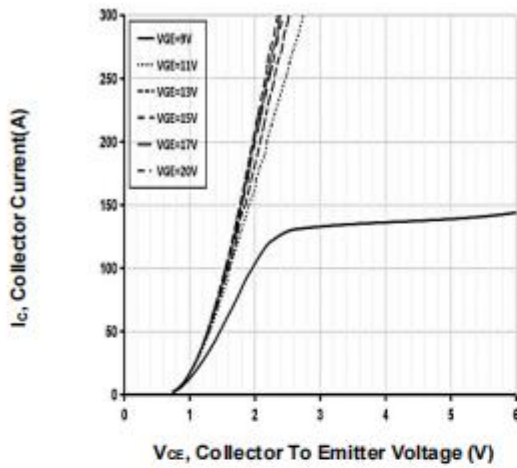


Figure 1. Typical output characteristic
($T_j = 25^\circ\text{C}$)

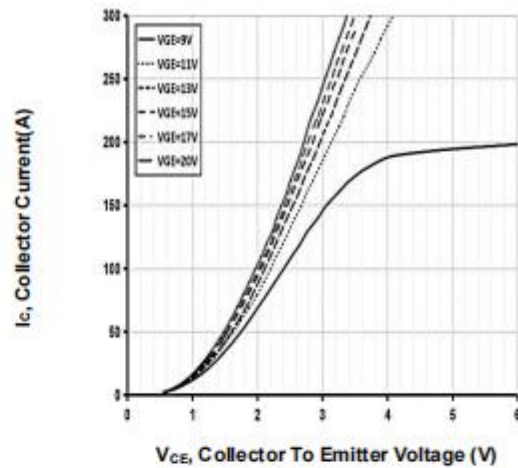


Figure 2. Typical output characteristic
($T_j = 175^\circ\text{C}$)

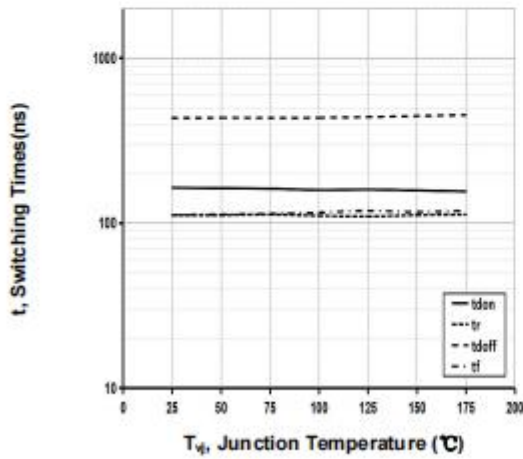


Figure 3. Typical switching times vs. T_j
(Ind. Load, $V_{CE} = 400\text{V}$, $V_{GE} = 15/0\text{V}$, $I_C = 160\text{A}$, $R_G = 10\Omega$)

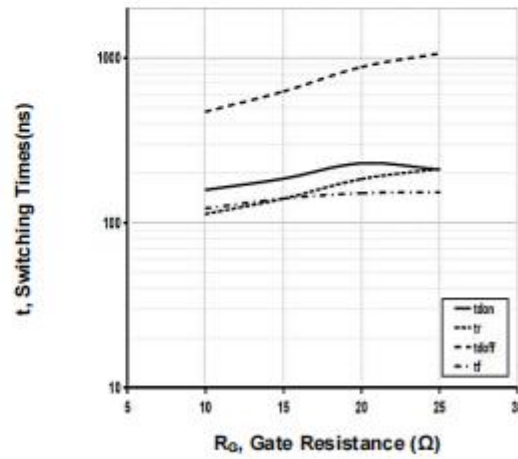


Figure 4. Typical switching times vs. gate resistor
(Ind. Load, $T_j = 175^\circ\text{C}$, $V_{CE} = 400\text{V}$, $V_{GE} = 15/0\text{V}$, $I_C = 160\text{A}$)

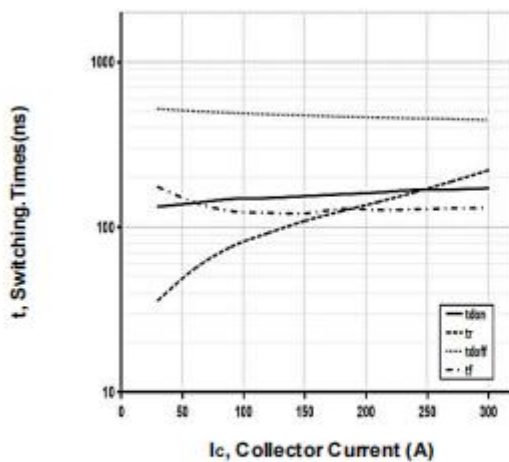


Figure 5. Typical switching times vs. collector current
(Ind. load, $T_j = 175^\circ\text{C}$, $V_{CE} = 400\text{V}$, $V_{GE} = 15/0\text{V}$, $R_G = 10\Omega$)

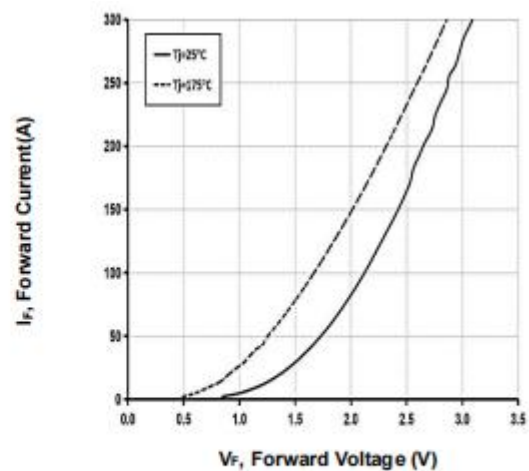


Figure 6. Typical diode forward current vs. forward voltage

TO-247PLUS-3L Package Outline

Unit: mm

Symbol	Min	Nom	Max	Symbol	Min	Nom	Max
A	4.80	5.00	5.20	D1	16.15	16.55	16.95
A1	2.20	2.40	2.60	E	15.50	15.80	16.10
A2	1.85		2.15	E1	13.00	13.30	13.60
b	1.07	1.20	1.33	E2	5.00		5.50
b2	1.90		2.16	E3	1.90		2.60
b4	2.90		3.20	e		5.44	
c	0.52	0.60	0.68	L	19.30		19.90
D	20.70	21.00	21.30	L1	3.75	3.95	4.15

