21A, 1200V, NPT Series N-Channel IGBTs with Anti-Parallel Hyperfast Diodes

The HGTG5N120BN, HGTP5N120BND, and HGT1S5N120BNDS are **N**on-**P**unch **T**hrough (NPT) IGBT designs. They are new members of the MOS gated high voltage switching IGBT family. IGBTs combine the best features of MOSFETs and bipolar transistors. This device has the high input impedance of a MOSFET and the low on-state conduction loss of a bipolar transistor. The IGBT used is the development type TA49308. The Diode used is the development type TA49058 (Part number RHRD6120).

The IGBT is ideal for many high voltage switching applications operating at moderate frequencies where low conduction losses are essential, such as: AC and DC motor controls, power supplies and drivers for solenoids, relays and contactors.

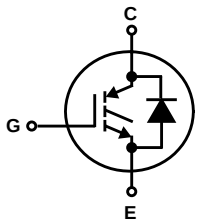
Formerly Developmental Type TA49306.

Ordering Information

PART NUMBER	PACKAGE	BRAND
HGTG5N120BND	TO-247	5N120BND
HGTP5N120BND	TO-220AB	5N120BND
HGT1S5N120BNDS	TO-263AB	5N120BND

NOTE: When ordering, use the entire part number. Add the suffix 9A to obtain the TO-263AB variant in Tape and Reel, i.e., HGT1S5N120BNS9A.

Symbol

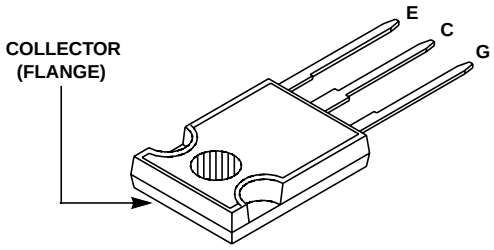


Features

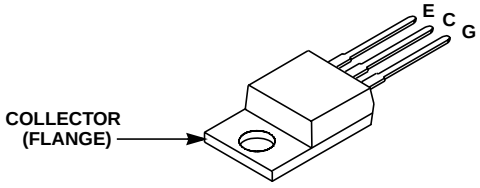
- 21A, 1200V, $T_C = 25^oC$
- 1200V Switching SOA Capability
- Typical Fall Time. . . . . 175ns at $T_J = 150^oC$
- Short Circuit Rating
- Low Conduction Loss
- *Thermal Impedance* SPICE Model
  Temperature Compensating SABER™ Model
  www.intersil.com
- Related Literature
  - TB334 “Guidelines for Soldering Surface Mount Components to PC Boards”

Packaging

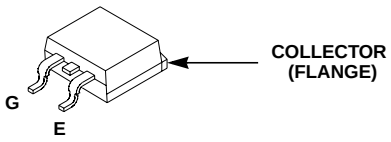
JEDEC STYLE TO-247



JEDEC TO-220AB (ALTERNATE VERSION)



JEDEC TO-263AB



INTERSIL CORPORATION IGBT PRODUCT IS COVERED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS

4,364,073	4,417,385	4,430,792	4,443,931	4,466,176	4,516,143	4,532,534	4,587,713
4,598,461	4,605,948	4,620,211	4,631,564	4,639,754	4,639,762	4,641,162	4,644,637
4,682,195	4,684,413	4,694,313	4,717,679	4,743,952	4,783,690	4,794,432	4,801,986
4,803,533	4,809,045	4,809,047	4,810,665	4,823,176	4,837,606	4,860,080	4,883,767
4,888,627	4,890,143	4,901,127	4,904,609	4,933,740	4,963,951	4,969,027	

Absolute Maximum Ratings $T_C = 25^oC$, Unless Otherwise Specified

		HGTG5N120BND HGTP5N120BND HGT1S5N120BNDS	UNITS
Collector to Emitter Voltage	BV_{CES}	1200	V
Collector Current Continuous			
At $T_C = 25^oC$	I_{C25}	21	A
At $T_C = 110^oC$	I_{C110}	10	A
Collector Current Pulsed (Note 1)	I_{CM}	40	A
Gate to Emitter Voltage Continuous	V_{GES}	±20	V
Gate to Emitter Voltage Pulsed	V_{GEM}	±30	V
Switching Safe Operating Area at $T_J = 150^oC$ (Figure 2)	SSOA	30A at 1200V	
Power Dissipation Total at $T_C = 25^oC$	P_D	167	W
Power Dissipation Derating $T_C > 25^oC$		1.33	$W/^oC$
Operating and Storage Junction Temperature Range	T_J, T_{STG}	-55 to 150	^oC
Maximum Lead Temperature for Soldering			
Leads at 0.063in (1.6mm) from case for 10s	T_L	300	^oC
Package Body for 10s, see Tech Brief 334	T_{pkg}	260	^oC
Short Circuit Withstand Time (Note 2) at $V_{GE} = 15V$	t_{SC}	8	µs
Short Circuit Withstand Time (Note 2) at $V_{GE} = 12V$	t_{SC}	15	µs

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

NOTES:

1. Pulse width limited by maximum junction temperature.
2. $V_{CE(PK)} = 840V$, $T_J = 125^oC$, $R_G = 25\Omega$.

Electrical Specifications $T_C = 25^oC$, Unless Otherwise Specified

PARAMETER	SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNITS
Collector to Emitter Breakdown Voltage	BV_{CES}	$I_C = 250\mu A$, $V_{GE} = 0V$		1200	-	-	V
Collector to Emitter Leakage Current	I_{CES}	$V_{CE} = BV_{CES}$	$T_C = 25^oC$	-	-	250	µA
			$T_C = 125^oC$	-	100	-	µA
			$T_C = 150^oC$	-	-	1.5	mA
Collector to Emitter Saturation Voltage	$V_{CE(SAT)}$	$I_C = 5A$, $V_{GE} = 15V$	$T_C = 25^oC$	-	2.45	2.7	V
			$T_C = 150^oC$	-	3.7	4.2	V
Gate to Emitter Threshold Voltage	$V_{GE(TH)}$	$I_C = 45\mu A$, $V_{CE} = V_{GE}$		6.0	6.8	-	V
Gate to Emitter Leakage Current	I_{GES}	$V_{GE} = \pm 20V$		-	-	±250	nA
Switching SOA	SSOA	$T_J = 150^oC$, $R_G = 25\Omega$, $V_{GE} = 15V$, L = 5mH, $V_{CE(PK)} = 1200V$		30	-	-	A
Gate to Emitter Plateau Voltage	V_{GEP}	$I_C = 5A$, $V_{CE} = 0.5\ BV_{CES}$		-	10.5	-	V
On-State Gate Charge	$Q_{G(ON)}$	$I_C = 5A$, $V_{CE} = 0.5\ BV_{CES}$	$V_{GE} = 15V$	-	53	65	nC
			$V_{GE} = 20V$	-	60	72	nC
Current Turn-On Delay Time	$t_{d(ON)I}$	IGBT and Diode at $T_J = 25^oC$, $I_{CE} = 5A$, $V_{CE} = 0.8\ BV_{CES}$, $V_{GE} = 15V$, $R_G = 25\Omega$, L = 5mH, Test Circuit (Figure 20)		-	22	25	ns
Current Rise Time	t_{rI}			-	15	20	ns
Current Turn-Off Delay Time	$t_{d(OFF)I}$			-	160	180	ns
Current Fall Time	t_{fI}			-	130	160	ns
Turn-On Energy	E_{ON}			-	450	600	µJ
Turn-Off Energy (Note 3)	E_{OFF}			-	390	450	µJ

Electrical Specifications $T_C = 25^oC$, Unless Otherwise Specified **(Continued)**

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Current Turn-On Delay Time	$t_{d(ON)I}$	IGBT and Diode at $T_J = 150^oC$, $I_{CE} = 5A$, $V_{CE} = 0.8\ BV_{CES}$, $V_{GE} = 15V$, $R_G = 25\Omega$, L = 5mH, Test Circuit (Figure 20)	-	20	25	ns
Current Rise Time	t_{rI}		-	15	20	ns
Current Turn-Off Delay Time	$t_{d(OFF)I}$		-	182	280	ns
Current Fall Time	t_{fI}		-	175	200	ns
Turn-On Energy	E_{ON}		-	1000	1300	µJ
Turn-Off Energy (Note 3)	E_{OFF}		-	560	800	µJ
Diode Forward Voltage	V_{EC}	$I_{EC} = 10A$	-	2.70	3.50	V
Diode Reverse Recovery Time	t_{rr}	$I_{EC} = 7A$, $dI_{EC}/dt = 200A/\mu s$	-	50	60	ns
		$I_{EC} = 1A$, $dI_{EC}/dt = 200A/\mu s$	-	30	40	ns
Thermal Resistance Junction To Case	$R_{\theta JC}$	IGBT	-	-	0.75	$^oC/W$
		Diode	-	-	1.75	$^oC/W$

NOTE:

3. Turn-Off Energy Loss (E_{OFF}) is defined as the integral of the instantaneous power loss starting at the trailing edge of the input pulse and ending at the point where the collector current equals zero ($I_{CE} = 0A$). All devices were tested per JEDEC Standard No. 24-1 Method for Measurement of Power Device Turn-Off Switching Loss. This test method produces the true total Turn-Off Energy Loss.

Typical Performance Curves Unless Otherwise Specified

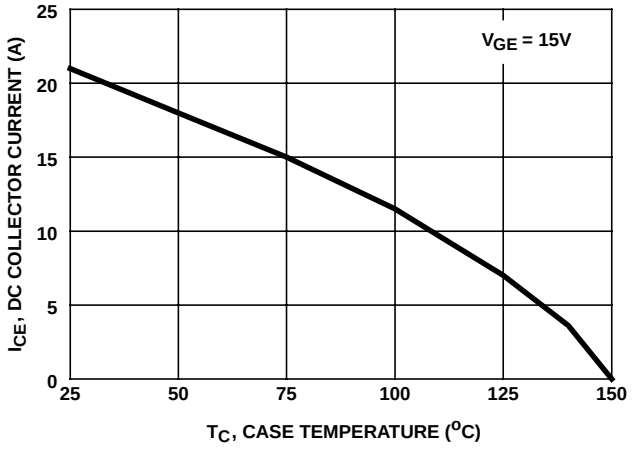


FIGURE 1. DC COLLECTOR CURRENT vs CASE TEMPERATURE

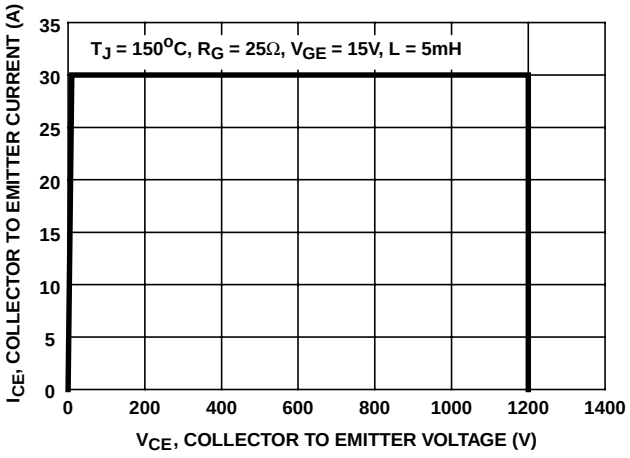


FIGURE 2. MINIMUM SWITCHING SAFE OPERATING AREA