

March 1997

10A, 400V and 500V N-Channel IGBTs

Features

- 10A, 400V and 500V
- $V_{CE(ON)}$ 2.5V Max.
- $T_{FALL} \leq 1.4\mu s$
- Low On-State Voltage
- Fast Switching Speeds
- High Input Impedance

Applications

- Power Supplies
- Motor Drives
- Protective Circuits

Description

The HGTD10N40F1, HGTD10N40F1S, HGTD10N50F1, and HGTD10N50F1S are n-channel enhancement-mode insulated gate bipolar transistors (IGBTs) designed for high voltage, low on-dissipation applications such as switching regulators and motor drivers. These types can be operated directly from low power integrated circuits.

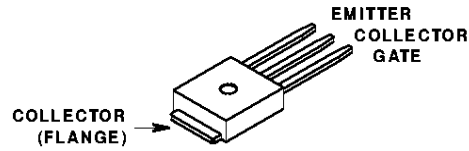
PACKAGING AVAILABILITY

PART NUMBER	PACKAGE	BRAND
HGTD10N40F1	TO-251AA	G10N40
HGTD10N50F1	TO-251AA	G10N50
HGTD10N40F1S	TO-252AA	G10N40
HGTD10N50F1S	TO-252AA	G10N50

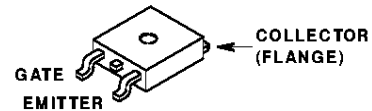
NOTE: When ordering, use the entire part number. Add the suffix 9A to obtain the TO-252AA variant in the tape and reel, i.e., HGTD10N40F19A.

Packages

HGTD10N40F1, HGTD10N50F1
JEDEC TO-251AA

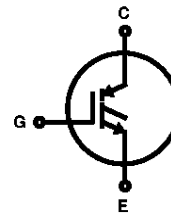


HGTD10N40F1S, HGTD10N50F1S
JEDEC TO-252AA



Terminal Diagram

N-CHANNEL ENHANCEMENT MODE



Absolute Maximum Ratings $T_C = +25^\circ C$, Unless Otherwise Specified

	HGTD10N40F1 HGTD10N40F1S	HGTD10N50F1 HGTD10N50F1S	UNITS
Collector-Emitter Voltage	400	500	V
Collector-Gate Voltage $R_{GE} = 1M\Omega$	400	500	V
Gate-Emitter Voltage	± 20	± 20	V
Collector Current Continuous at $T_C = +25^\circ C$	12	12	A
at $T_C = +90^\circ C$	10	10	A
Power Dissipation Total at $T_C = +25^\circ C$	75	75	W
Power Dissipation Derating $T_C > +25^\circ C$	0.6	0.6	W/ $^\circ C$
Operating and Storage Junction Temperature Range	-55 to +150	-55 to +150	$^\circ C$

HARRIS SEMICONDUCTOR IGBT PRODUCT IS COVERED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS:

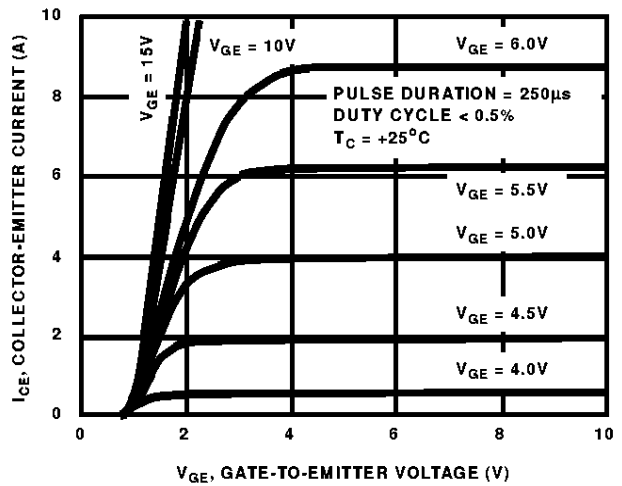
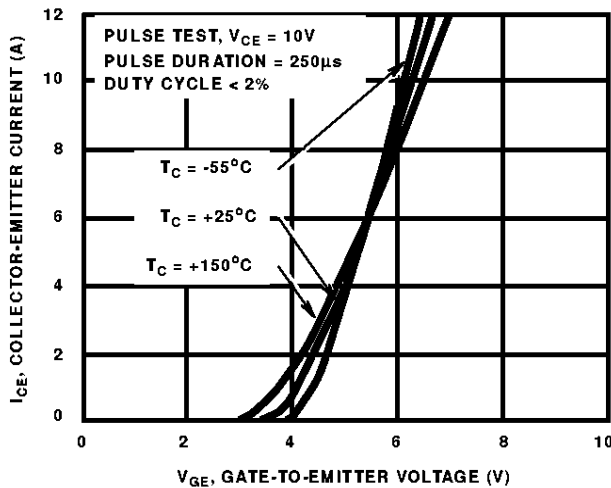
4,364,073	4,417,385	4,430,792	4,443,931	4,466,176	4,516,143	4,532,534	4,567,641
4,587,713	4,598,461	4,605,948	4,618,872	4,620,211	4,631,564	4,639,754	4,639,762
4,641,162	4,644,637	4,682,195	4,684,413	4,694,313	4,717,679	4,743,952	4,783,690
4,794,432	4,801,986	4,803,533	4,809,045	4,809,047	4,810,665	4,823,176	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							

Specifications HGTD10N40F1, HGTD10N40F1S, HGTD10N50F1, HGTD10N50F1S

Electrical Specifications $T_C = +25^\circ\text{C}$, Unless Otherwise Specified

PARAMETERS	SYMBOL	TEST CONDITIONS	LIMITS				UNITS
			HGTD10N40F1 HGTD10N40F1S		HGTD10N50F1 HGTD10N50F1S		
			MIN	MAX	MIN	MAX	
Collector-Emitter Breakdown Voltage	BV_{CES}	$I_C = 250\mu\text{A}, V_{GE} = 0\text{V}$	400	-	500	-	V
Gate Threshold Voltage	$V_{GE(TH)}$	$V_{GE} = V_{CE}, I_C = 1\text{mA}$	2.0	4.5	2.0	4.5	V
Zero Gate Voltage Collector Current	I_{CES}	$T_J = +150^\circ\text{C}, V_{CE} = 400\text{V}$	-	250	-	-	μA
		$T_J = +150^\circ\text{C}, V_{CE} = 500\text{V}$	-	-	-	250	μA
Gate-Emitter Leakage Current	I_{GES}	$V_{GE} = \pm 20\text{V}, V_{CE} = 0\text{V}$	-	100	-	100	nA
Collector-Emitter On-Voltage	$V_{CE(ON)}$	$T_J = +150^\circ\text{C}, I_C = 5\text{A}, V_{GE} = 10\text{V}$	-	2.5	-	2.5	V
		$T_J = +150^\circ\text{C}, I_C = 5\text{A}, V_{GE} = 15\text{V}$	-	2.2	-	2.2	V
		$T_J = +25^\circ\text{C}, I_C = 5\text{A}, V_{GE} = 10\text{V}$	-	2.5	-	2.5	V
		$T_J = +25^\circ\text{C}, I_C = 5\text{A}, V_{GE} = 15\text{V}$	-	2.2	-	2.2	V
Gate-Emitter Plateau Voltage	V_{GEP}	$I_C = 5\text{A}, V_{CE} = 10\text{V}$	5.3 (Typ)				V
On-State Gate Charge	$Q_{G(ON)}$	$I_C = 5\text{A}, V_{CE} = 10\text{V}$	13.4 (Typ)				nC
Turn-On Delay Time	$t_{D(ON)}$	Resistive Load, $I_C = 5\text{A}, V_{CE} = 400\text{V}, R_L = 80\Omega, T_J = +150^\circ\text{C}, V_{GE} = 10\text{V}, R_G = 25\Omega$	45 (Typ)				ns
Rise Time	t_{RI}		35 (Typ)				ns
Turn-Off Delay Time	$t_{D(OFF)}$		130 (Typ)				ns
Fall Time	t_{FI}		1400 (Typ)				ns
Turn-Off Energy Loss Per Cycle (Off Switching Dissipation = $W_{OFF} \times$ Frequency)	W_{OFF}		0.64 (Typ)				mJ
Turn-Off Delay Time	$t_{D(OFF)}$		Inductive Load (See Figure 11), $I_C = 5\text{A}, V_{CE(CLIP)} = 400\text{V}, R_L = 80\Omega, L = 50\mu\text{H}, T_J = +150^\circ\text{C}, V_{GE} = 10\text{V}, R_G = 25\Omega$	-	375	-	375
Fall Time	t_{FI}	-		1200	-	1200	ns
Turn-Off Energy Loss Per Cycle (Off Switching Dissipation = $W_{OFF} \times$ Frequency)	W_{OFF}	-		1.2	-	1.2	mJ
Thermal Resistance Junction-to-Case (IGBT)	$R_{\theta JC}$		-	1.67	-	1.67	$^\circ\text{C/W}$

Typical Performance Curves



Typical Performance Curves (Continued)

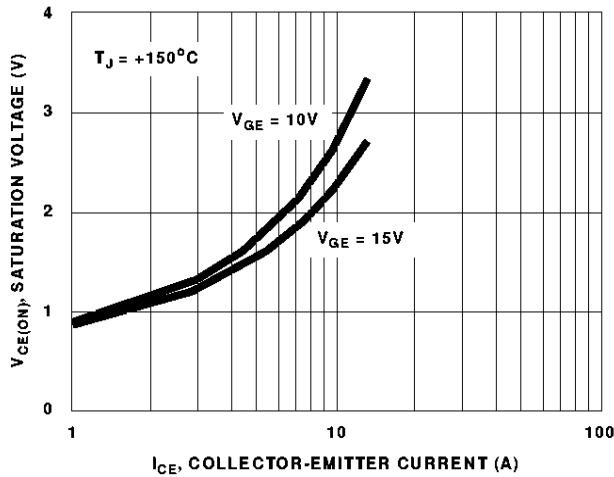


FIGURE 3. SATURATION VOLTAGE vs COLLECTOR-EMITTER CURRENT (TYPICAL)

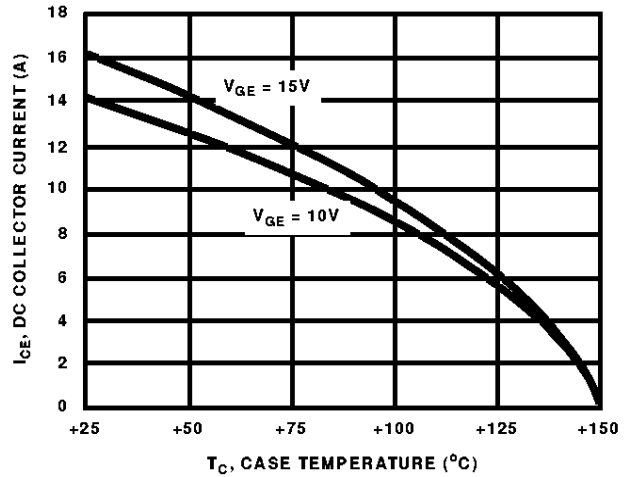


FIGURE 4. DC COLLECTOR CURRENT vs CASE TEMPERATURE

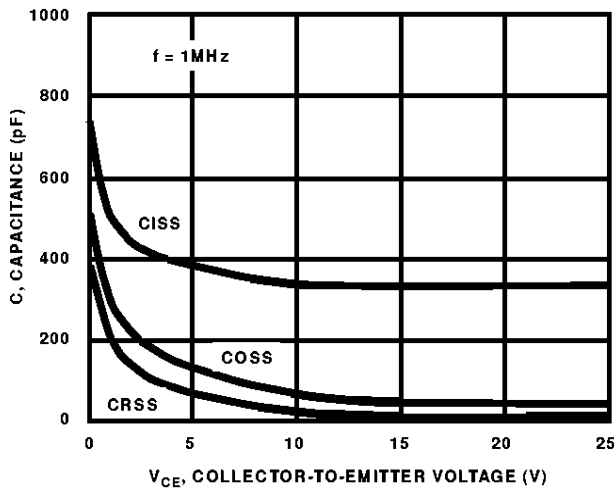


FIGURE 5. CAPACITANCE vs COLLECTOR-TO-EMITTER VOLTAGE (TYPICAL)

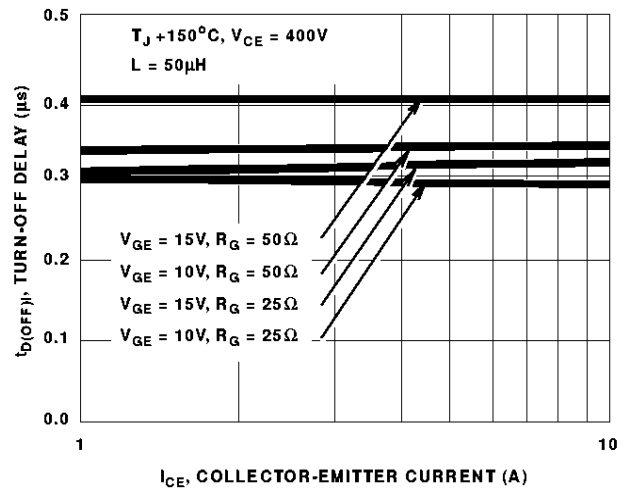


FIGURE 6. TURN-OFF DELAY vs COLLECTOR-TO-EMITTER CURRENT (TYPICAL)

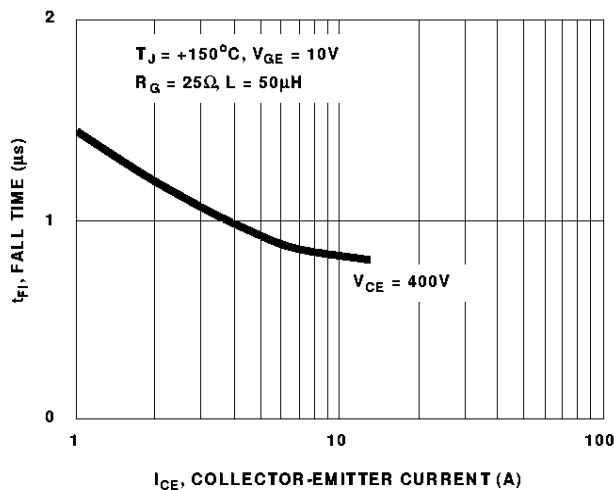


FIGURE 7. FALL TIME vs COLLECTOR-TO-EMITTER CURRENT (TYPICAL)

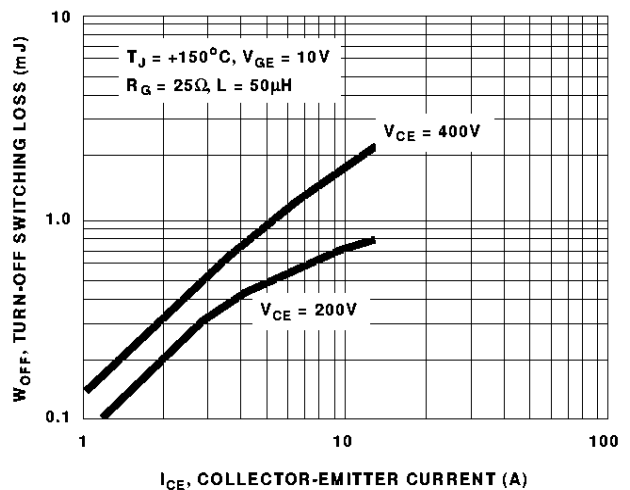
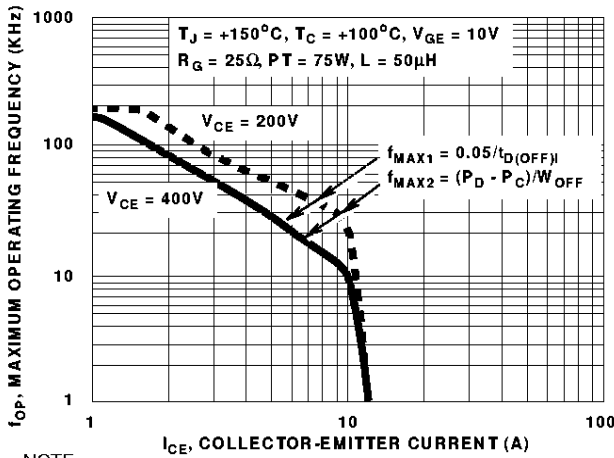


FIGURE 8. TURN-OFF SWITCHING LOSS vs COLLECTOR-EMITTER CURRENT (TYPICAL)

Typical Performance Curves (Continued)



NOTE:
 P_D = ALLOWABLE DISSIPATION P_C = CONDUCTION DISSIPATION

FIGURE 9. MAXIMUM OPERATING FREQUENCY vs COLLECTOR CURRENT AND VOLTAGE (TYPICAL)

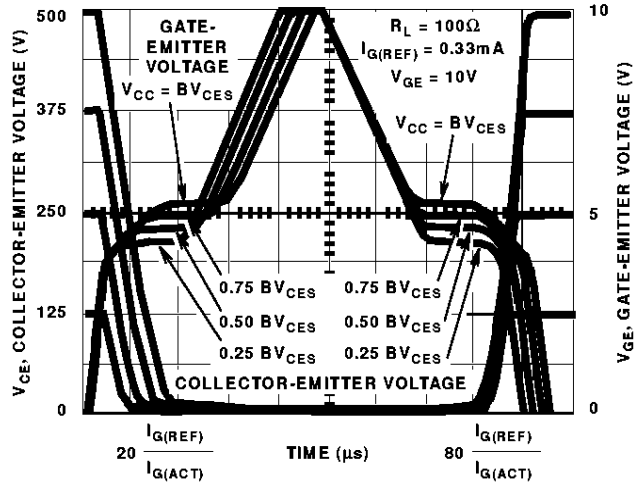


FIGURE 10. NORMALIZED SWITCHING WAVEFORMS AT CONSTANT GATE CURRENT

Test Circuit

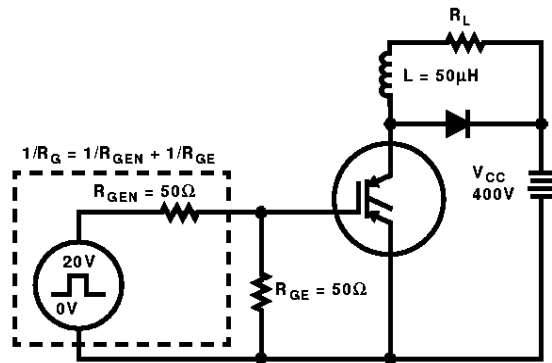


FIGURE 11. INDUCTIVE SWITCHING TEST CIRCUIT

Harris Semiconductor products are sold by description only. Harris Semiconductor reserves the right to make changes in circuit design and/or specifications at any time without notice. Accordingly, the reader is cautioned to verify that data sheets are current before placing orders. Information furnished by Harris is believed to be accurate and reliable. However, no responsibility is assumed by Harris or its subsidiaries for its use; nor for any infringements of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of Harris or its subsidiaries.

Sales Office Headquarters

For general information regarding Harris Semiconductor and its products, call 1-800-4-HARRIS

UNITED STATES

Harris Semiconductor
 1301 Woody Burke Road
 Melbourne, Florida 32902
 TEL: (407) 724-3000

EUROPE

Harris Semiconductor
 Mercure Centre
 Rue de la Fusee, 100
 1130 Brussels, Belgium
 TEL: (32) 2-246-2111

SOUTH ASIA

Harris Semiconductor H.K. Ltd.
 13/F Fourseas Building
 208-212 Nathan Road
 Tsimshatsui, Kowloon
 Hong Kong
 TEL: (852) 723-6339

NORTH ASIA

Harris K.K.
 Shinjuku NS Bldg. Box 6153
 2-4-1 Nishi-Shinjuku
 Shinjuku-Ku, Tokyo 163 Japan
 TEL: (81) 3-3345-8911

