intersil

HGTD6N40E1, HGTD6N40E1S, HGTD6N50E1, HGTD6N50E1S

March 1997

6A, 400V and 500V N-Channel IGBTs

Features

- **6A, 400V and 500V**
- **$V_{CE(ON)}$: 2.5V Max.**
- **T_{FALL}: 1.0μs**
- **Low On-State Voltage**
- **Fast Switching Speeds**
- **High Input Impedance**

Applications

- **Power Supplies**
- **Motor Drives**
- **Protective Circuits**

Description

The HGTD6N40E1, HGTD6N40E1S, HGTD6N50E1, and HGTD6N50E1S 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.

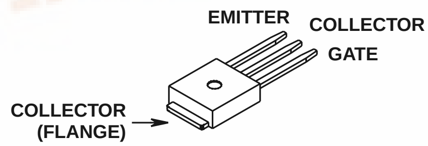
PACKAGING AVAILABILITY

PART NUMBER	PACKAGE	BRAND
HGTD6N40E1	TO-251AA	G6N40E
HGTD6N50E1	TO-251AA	G6N50E
HGTD6N40E1S	TO-252AA	G6N40E
HGTD6N50E1S	TO-252AA	G6N50E

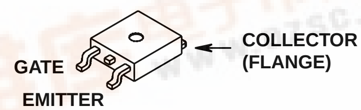
NOTE: When ordering, use the entire part number.

Packages

HGTD6N40E1, HGTD6N50E1
JEDEC TO-251AA

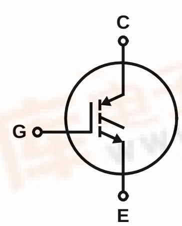


HGTD6N40E1S, HGTD6N50E1S
JEDEC TO-252AA



Terminal Diagram

N-CHANNEL ENHANCEMENT MODE



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

		HGTD6N40E1 HGTD6N40E1S	HGTD6N50E1 HGTD6N50E1S	UNITS
Collector-Emitter Voltage	V_{CES}	400	500	V
Collector-Gate Voltage R_{GE} = 1MΩ	V_{CGR}	400	500	V
Gate-Emitter Voltage	V_{GE}	±20	±20	V
Collector Current Continuous at $T_C = +25^oC$	I_{C25}	7.5	7.5	A
at $T_C = +90^oC$	I_{C90}	6.0	6.0	A
Power Dissipation Total at $T_C = +25^oC$	P_D	60	60	W
Power Dissipation Derating $T_C > +25^oC$		0.48	0.48	W/^{o}C
Operating and Storage Junction Temperature Range	T_J, T_{STG}	-55 to +150	-55 to +150	^{o}C

INTERSIL CORPORATION'S 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							

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

PARAMETERS	SYMBOL	TEST CONDITIONS	LIMITS				UNITS
			HGTD6N40E1 HGTD6N40E1S		HGTD6N50E1 HGTD6N50E1S		
			MIN	MAX	MIN	MAX	
Collector-Emitter Breakdown Voltage	BV_{CES}	$I_C = 250\mu A$, $V_{GE} = 0V$	400	-	500	-	V
Gate Threshold Voltage	$V_{GE(TH)}$	$V_{GE} = V_{CE}$, $I_C = 1mA$	2.0	4.5	2.0	4.5	V
Zero Gate Voltage Collector Current	I_{CES}	$T_J = +150^oC$, $V_{CE} = 400V$	-	250	-	-	µA
		$T_J = +150^oC$, $V_{CE} = 500V$	-	-	-	250	µA
Gate-Emitter Leakage Current	I_{GES}	$V_{GE} = \pm 20V$, $V_{CE} = 0V$	-	100	-	100	nA
Collector-Emitter On-Voltage	$V_{CE(ON)}$	$T_J = +150^oC$, $I_C = 3A$, $V_{GE} = 10V$	-	2.9	-	2.9	V
		$T_J = +150^oC$, $I_C = 3A$, $V_{GE} = 15V$	-	2.5	-	2.5	V
		$T_J = +25^oC$, $I_C = 3A$, $V_{GE} = 10V$	-	2.5	-	2.5	V
		$T_J = +25^oC$, $I_C = 3A$, $V_{GE} = 15V$	-	2.4	-	2.4	V
Gate-Emitter Plateau Voltage	V_{GEP}	$I_C = 3A$, $V_{CE} = 10V$	6.5 (Typ)				V
On-State Gate Charge	$Q_{G(ON)}$	$I_C = 3A$, $V_{CE} = 10V$	6.9 (Typ)				nC
Turn-On Delay Time	$t_{D(ON)}$	Resistive Load, $I_C = 3A$, $V_{CE} = 400V$, $R_L = 133\Omega$, $T_J = +150^oC$, $V_{GE} = 10V$, $R_G = 25\Omega$	90 (Typ)				ns
Rise Time	t_R		32 (Typ)				ns
Turn-Off Delay Time	$t_{D(OFF)}$		24 (Typ)				ns
Fall Time	t_F		1100 (Typ)				ns
Turn-Off Energy Loss Per Cycle (Off Switching Dissipation = W_{OFF} x Frequency)	W_{OFF}		0.29 (Typ)				mJ
Turn-Off Delay Time	$t_{D(OFF)I}$	Inductive Load (See Figure 11), $I_C = 3A$, $V_{CE(CLP)} = 400V$, $R_L = 133\Omega$, $L = 50\mu H$, $T_J = +150^oC$, $V_{GE} = 10V$, $R_G = 25\Omega$	-	190	-	190	ns
Fall Time	t_{FI}		-	1	-	1	µs
Turn-Off Energy Loss Per Cycle (Off Switching Dissipation = W_{OFF} x Frequency)	W_{OFF}		-	0.43	-	0.43	mJ
Thermal Resistance Junction-to-Case (IGBT)	$R_{\theta JC}$		-	2.08	-	2.08	$^oC/W$

Typical Performance Curves

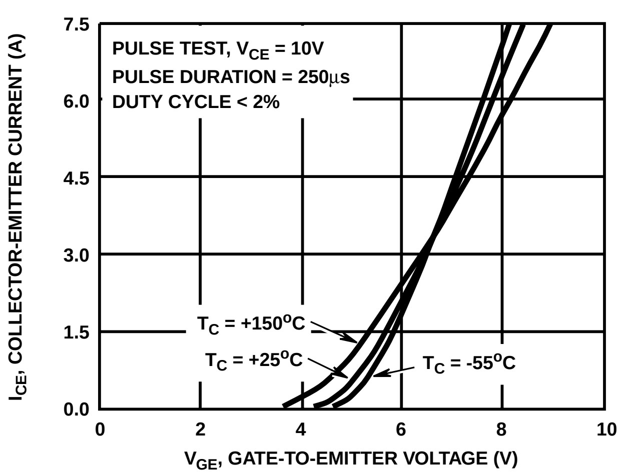


FIGURE 1. TYPICAL TRANSFER CHARACTERISTICS

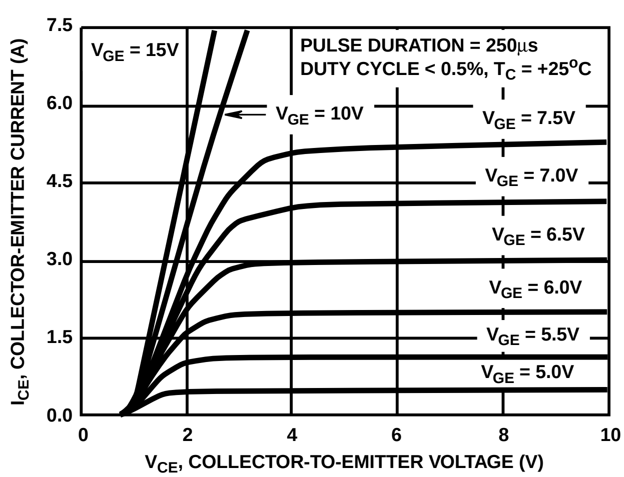


FIGURE 2. TYPICAL SATURATION CHARACTERISTICS

Typical Performance Curves (Continued)

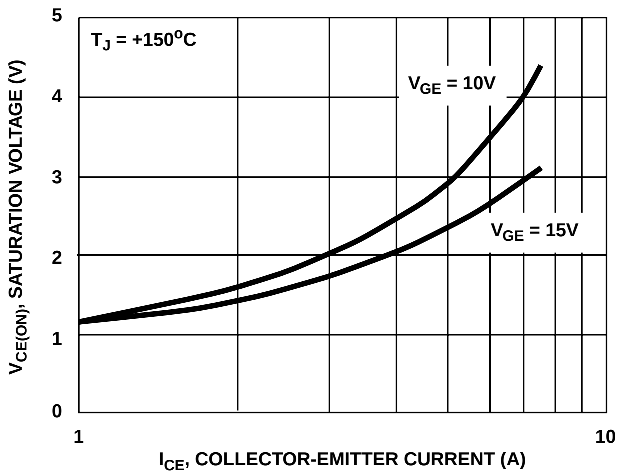


FIGURE 3. SATURATION VOLTAGE vs COLLECTOR-EMITTER CURRENT (TYPICAL)

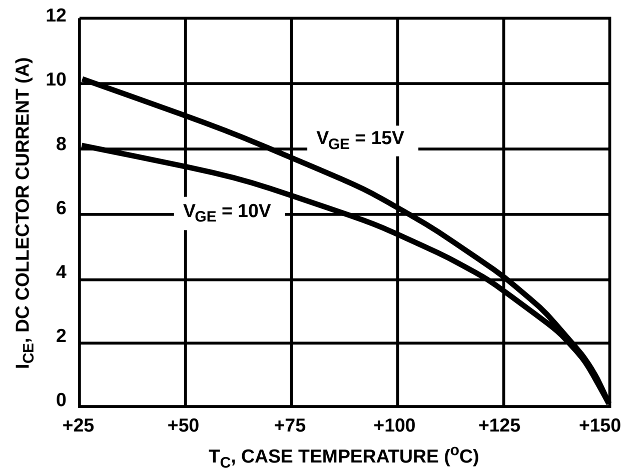


FIGURE 4. DC COLLECTOR CURRENT vs CASE TEMPERATURE

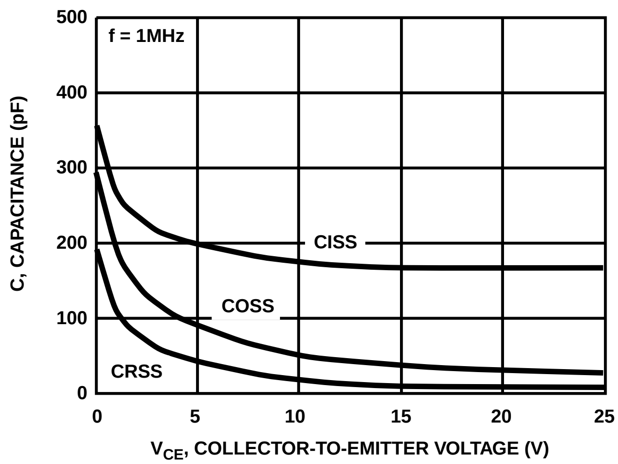


FIGURE 5. CAPACITANCE vs COLLECTOR-TO-EMITTER VOLTAGE (TYPICAL)

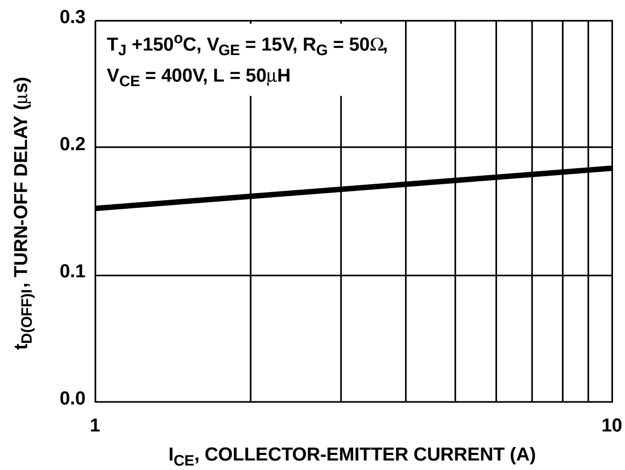


FIGURE 6. TURN-OFF DELAY vs COLLECTOR-TO-EMITTER CURRENT (TYPICAL)

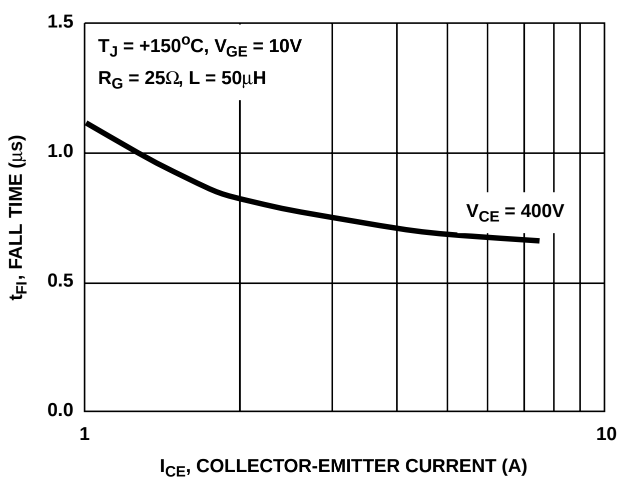


FIGURE 7. FALL TIME vs COLLECTOR-TO-EMITTER CURRENT (TYPICAL)

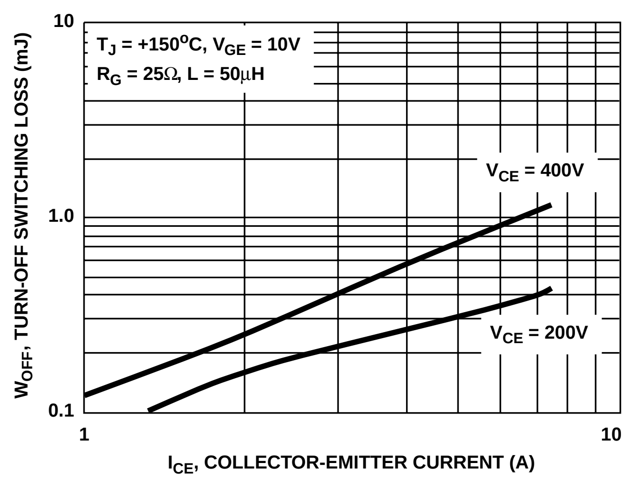


FIGURE 8. TURN-OFF SWITCHING LOSS vs COLLECTOR-EMITTER CURRENT (TYPICAL)

Typical Performance Curves (Continued)

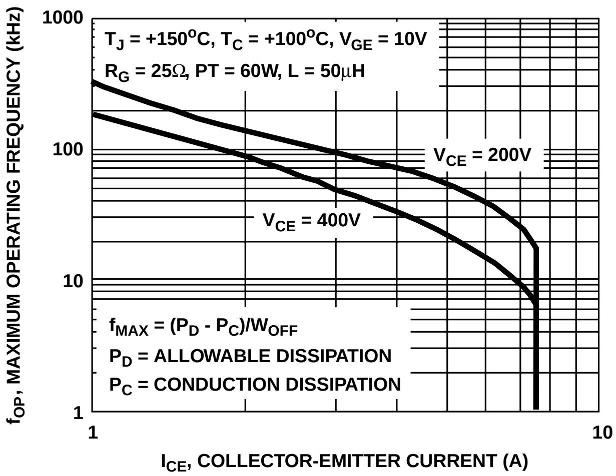


FIGURE 9. MAXIMUM OPERATING FREQUENCY vs COLLECTOR CURRENT AND VOLTAGE (TYPICAL)

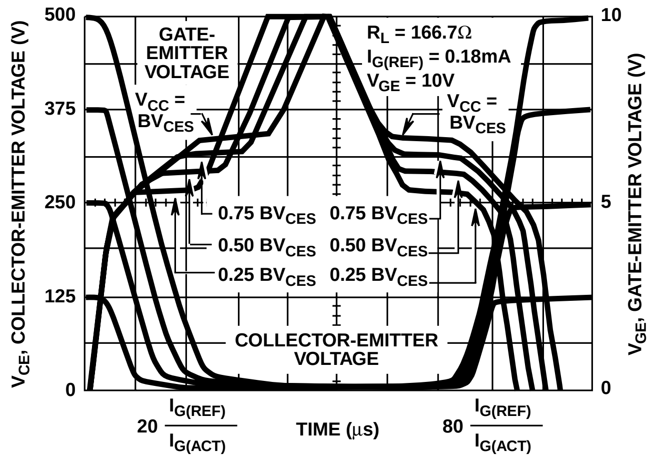


FIGURE 10. NORMALIZED SWITCHING WAVEFORMS AT CONSTANT GATE CURRENT

Test Circuit

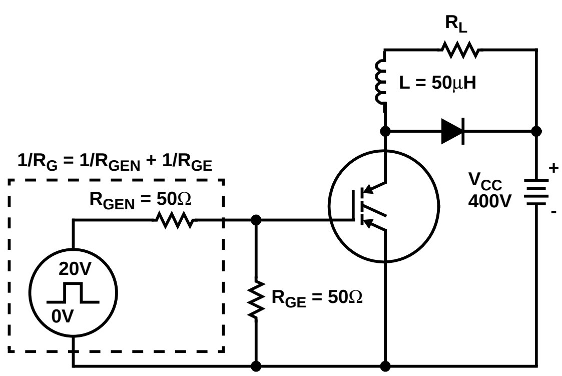


FIGURE 11. INDUCTIVE SWITCHING TEST CIRCUIT

Sales Office Headquarters

NORTH AMERICA
Intersil Corporation
P. O. Box 883, Mail Stop 53-204
Melbourne, FL 32902
TEL: (407) 724-7000
FAX: (407) 724-7240

EUROPE
Intersil SA
Mercure Center
100, Rue de la Fusee
1130 Brussels, Belgium
TEL: (32) 2.724.2111
FAX: (32) 2.724.22.05

ASIA
Intersil (Taiwan) Ltd.
Taiwan Limited
7F-6, No. 101 Fu Hsing North Road
Taipei, Taiwan
Republic of China
TEL: (886) 2 2716 9310
FAX: (886) 2 2715 3029