HGTP10N40C1, 40E1, 50C1, 50E1, HGTH12N40C1, 40E1, 50C1, 50E1

April 1995

10A, 12A, 400V and 500V N-Channel IGBTs

Features

- **10A and 12A, 400V and 500V**
- **$V_{CE(ON)}$: 2.5V Max.**
- **T_{FI}: 1μs, 0.5μs**
- **Low On-State Voltage**
- **Fast Switching Speeds**
- **High Input Impedance**
- **No Anti-Parallel Diode**

Applications

- **Power Supplies**
- **Motor Drives**
- **Protection Circuits**

Description

The HGTH12N40C1, HGTH12N40E1, HGTH12N50C1, HGTH12N50E1, HGTP10N40C1, HGTP10N40E1, HGTP10N50C1 and HGTP10N50E1 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.

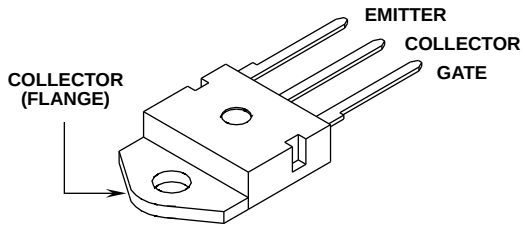
PACKAGING AVAILABILITY

PART NUMBER	PACKAGE	BRAND
HGTH12N40C1	TO-218AC	G12N40C1
HGTH12N40E1	TO-218AC	G12N40E1
HGTH12N50C1	TO-218AC	G12N50C1
HGTH12N50E1	TO-218AC	G12N50E1
HGTP10N40C1	TO-220AB	G10N40C1
HGTP10N40E1	TO-220AB	G10N40E1
HGTP10N50C1	TO-220AB	G10N50C1
HGTP10N50E1	TO-220AB	G10N50E1

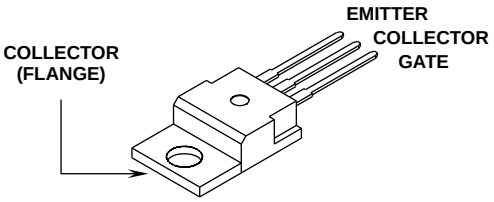
NOTE: When ordering, use the entire part number.

Packages

HGTH-TYPES JEDEC TO-218AC

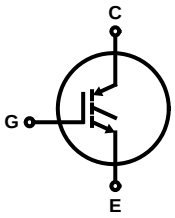


HGTP-TYPES JEDEC TO-220AB



Terminal Diagram

N-CHANNEL ENHANCEMENT MODE



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

	HGTH12N40C1 HGTH12N40E1	HGTH12N50C1 HGTH12N50E1	HGTP10N40C1 HGTP10N40E1	HGTP10N50C1 HGTP10N50E1	UNITS
Collector-Emitter Voltage . . . . . V_{CES}	400	500	400	500	V
Collector-Gate Voltage R_{GE} = 1MΩ . . . . . V_{CGR}	400	500	400	500	V
Reverse Collector-Emitter Voltage . . . . . V_{ECS}(rev.)	15	15	-5	-5	V
Gate-Emitter Voltage . . . . . V_{GE}	±20	±20	±20	±20	V
Collector Current Continuous . . . . . I_C	12	12	10	10	A
Collector Current Pulsed . . . . . I_{CM}	17.5	17.5	17.5	17.5	A
Power Dissipation at $T_C = +25^oC$ . . . . . P_D	75	75	60	60	W
Power Dissipation Derating Above $T_C > +25^oC$	0.6	0.6	0.48	0.48	W/^{o}C
Operating and Storage Junction Temperature Range . . . T_J, T_{STG}	-55 to +150	-55 to +150	-55 to +150	-55 to +150	^{o}C

CAUTION: These devices are sensitive to electrostatic discharge. Users should follow proper ESD Handling Procedures.

File Number **1697.3**

Electrical Specifications T_C = +25°C, Unless Otherwise Specified

PARAMETERS	SYMBOL	TEST CONDITIONS	LIMITS				UNITS
			HGTH12N40C1, E1, HGTP10N40C1, E1		HGTH12N50C1, E1, HGTP10N50C1, E1		
			MIN	MAX	MIN	MAX	
Collector-Emitter Breakdown Voltage	BV_{CES}	I_C = 1mA, V_{GE} = 0	400	-	500	-	V
Gate Threshold Voltage	$V_{GE(TH)}$	V_{GE} = V_{CE}, I_C = 1mA	2.0	4.5 3 (Typ)	2.0	4.5 3 (Typ)	V
Zero Gate Voltage Collector Current	I_{CES}	V_{CE} = 400V, T_C = +25°C	-	250	-	-	µA
		V_{CE} = 500V, T_C = +25°C	-	-	-	250	µA
		V_{CE} = 400V, T_C = +125°C	-	1000	-	-	µA
		V_{CE} = 500V, T_C = +125°C	-	-	-	1000	µA
Gate-Emitter Leakage Current	I_{GES}	V_{GE} = ±20V, V_{CE} = 0	-	100	-	100	nA
Collector-Emitter on Voltage	$V_{CE(ON)}$	I_C = 10A, V_{GE} = 10V	-	2.5	-	2.5	V
		I_C = 17.5A, V_{GE} = 20V	-	3.2	-	3.2	V
Gate-Emitter Plateau Voltage	V_{GEP}	I_C = 5A, V_{CE} = 10V	-	6 (Typ)	-	6 (Typ)	V
On-State Gate Charge	$Q_{G(ON)}$	I_C = 5A, V_{CE} = 10V	-	19 (Typ)	-	19 (Typ)	nC
Turn-On Delay Time	$t_{D(ON)I}$	I_C = 10A, $V_{CE(CLP)}$ = 300V, L = 50µH, T_J = +100°C, V_{GE} = 10V, R_G = 50Ω	-	50	-	50	ns
Rise Time	t_{RI}		-	50	-	50	ns
Turn-Off Delay Time	$t_{D(OFF)I}$		-	400	-	400	ns
Fall Time	t_{FI}						
40E1, 50E1			680 (Typ)	1000	680 (Typ)	1000	ns
40C1, 50C1			400	500	400	500	ns
Turn-Off Energy Loss per Cycle (Off Switching Dissipation = W_{OFF} x Frequency)	W_{OFF}	I_C = 10A, $V_{CE(CLP)}$ = 300V, L = 50µH, T_J = +100°C, V_{GE} = 10V, R_G = 50Ω					
40E1, 50E1			680 (Typ)				µJ
40C1, 50C1			400 (Typ)				µJ
Thermal Resistance Junction-to-Case	$R_{\theta JC}$	HGTH, HGTM	-	1.67	-	1.67	°C/W
		HGTP	-	2.083	-	2.083	°C/W

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

Typical Performance Curves

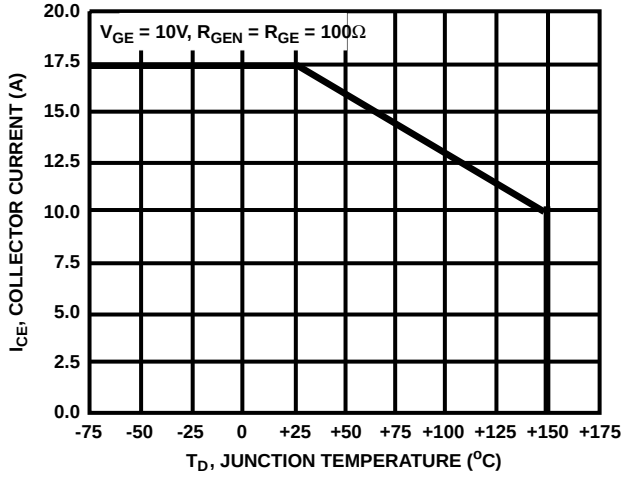


FIGURE 1. MAX. SWITCHING CURRENT LEVEL. R_G = 50Ω, V_{GE} = 0V ARE THE MIN. ALLOWABLE VALUES

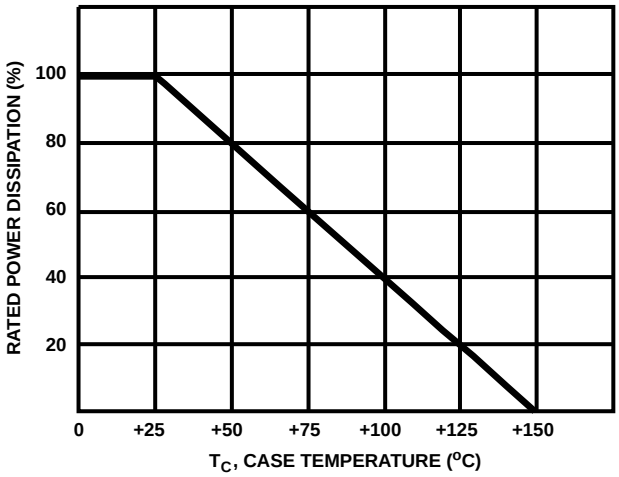


FIGURE 2. POWER DISSIPATION vs TEMPERATURE DERATING CURVE

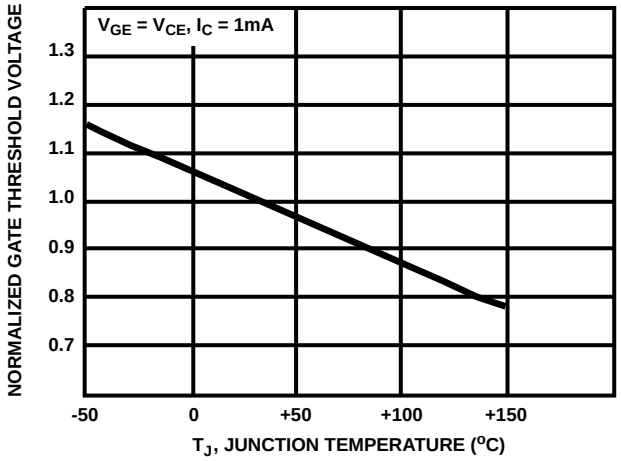


FIGURE 3. TYPICAL NORMALIZED GATE THRESHOLD VOLTAGE vs JUNCTION TEMPERATURE

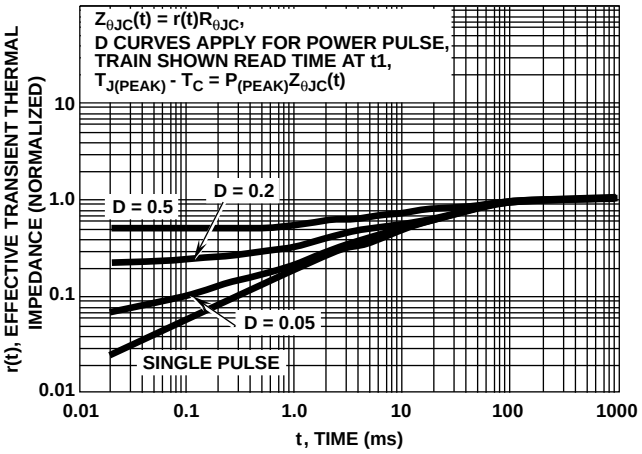


FIGURE 4. NORMALIZED THERMAL RESPONSE CHARACTERISTICS

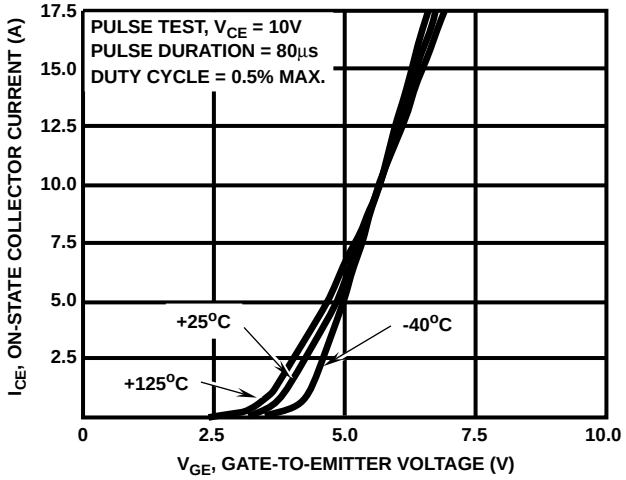


FIGURE 5. TYPICAL TRANSFER CHARACTERISTICS

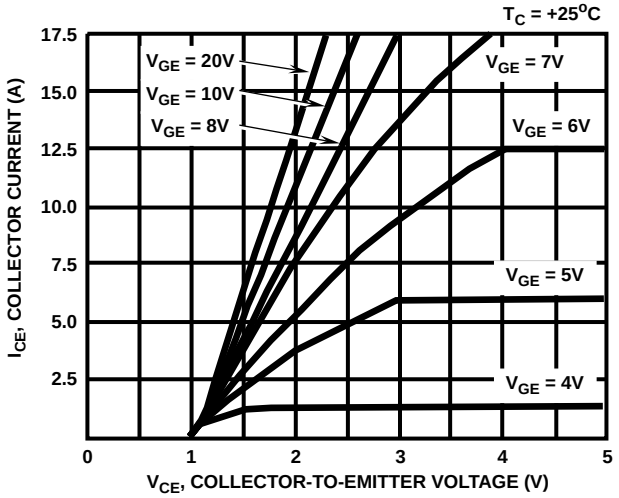


FIGURE 6. TYPICAL SATURATION CHARACTERISTICS

Typical Performance Curves (Continued)

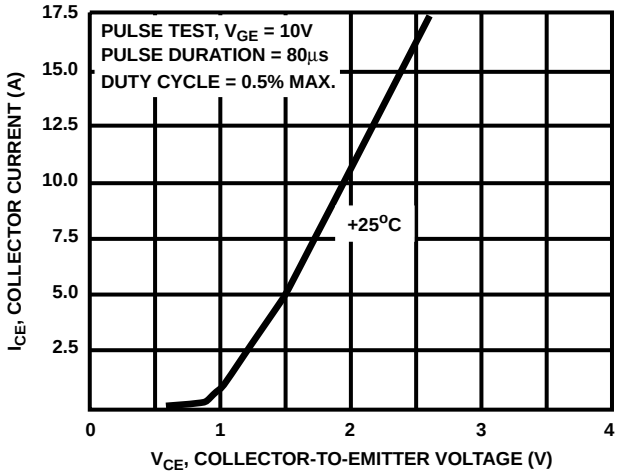


FIGURE 7. TYPICAL COLLECTOR-TO-EMITTER ON-VOLTAGE vs COLLECTOR CURRENT

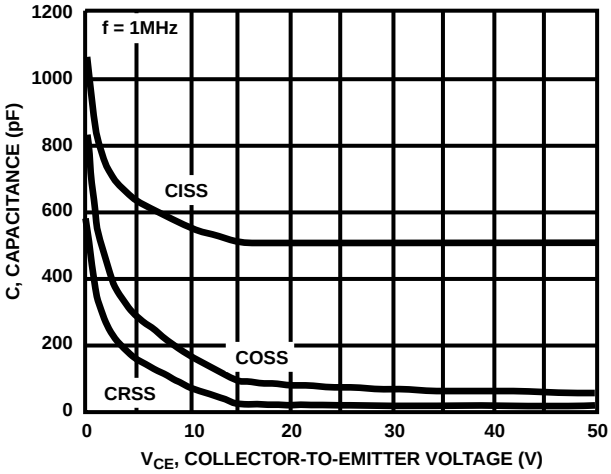


FIGURE 8. CAPACITANCE vs COLLECTOR-TO-EMITTER VOLTAGE

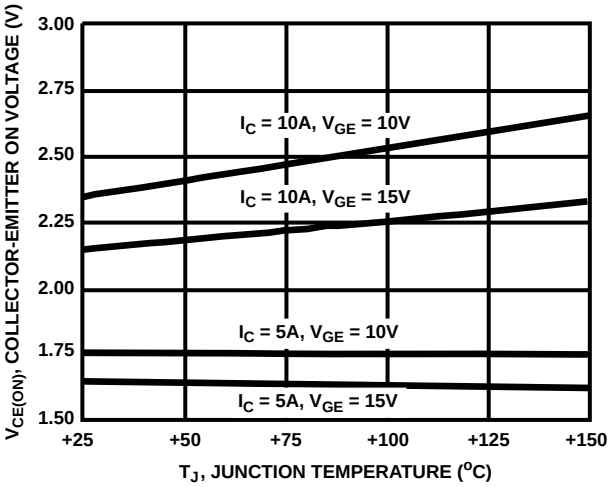


FIGURE 9. TYPICAL $V_{CE(ON)}$ vs TEMPERATURE

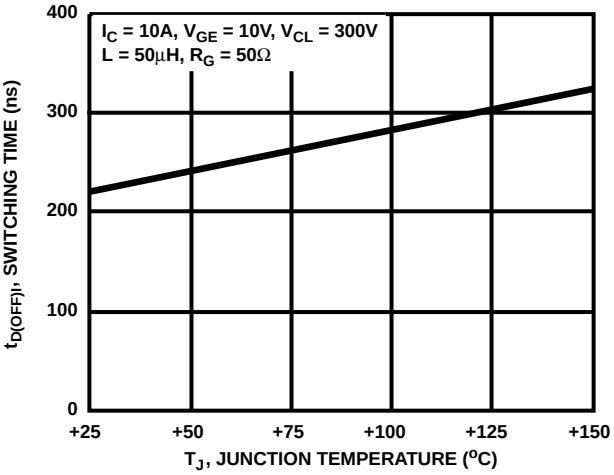


FIGURE 10. TYPICAL TURN-OFF DELAY TIME

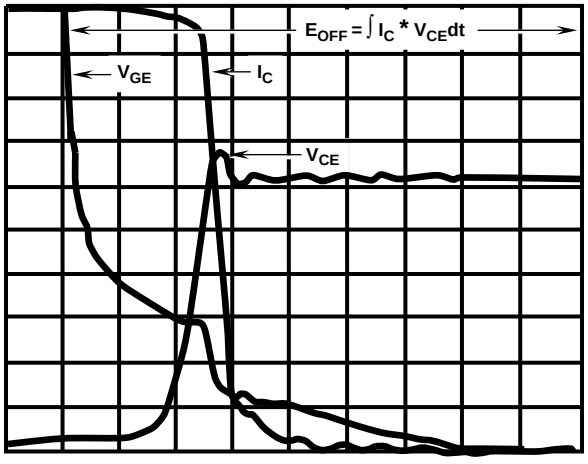


FIGURE 11. TYPICAL INDUCTIVE SWITCHING WAVEFORMS

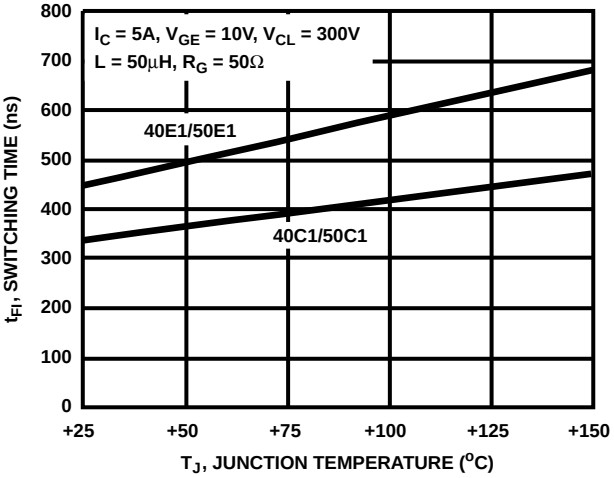


FIGURE 12. TYPICAL FALL TIME (I_C = 5A)

Typical Performance Curves (Continued)

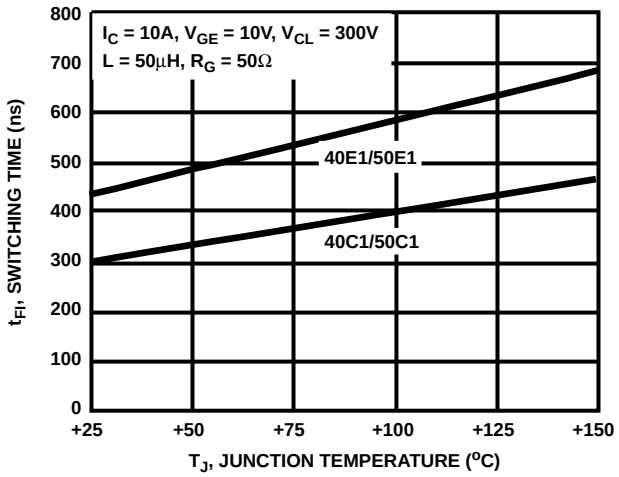


FIGURE 13. TYPICAL FALL TIME (I_C = 10A)

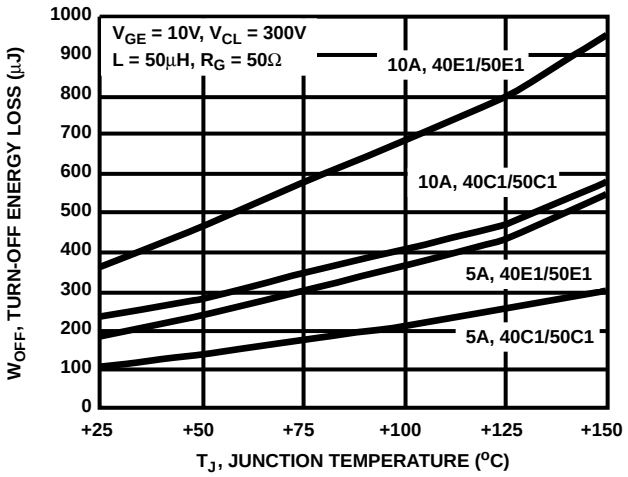


FIGURE 14. TYPICAL CLAMPED INDUCTIVE TURN-OFF SWITCHING LOSS/CYCLE

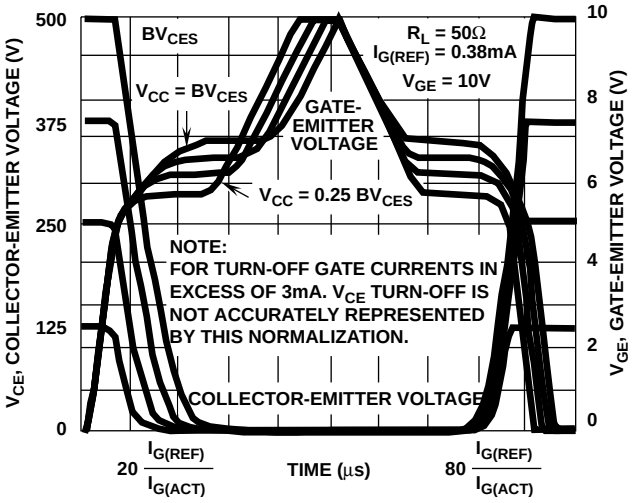


FIGURE 15. NORMALIZED SWITCHING WAVEFORMS AT CONSTANT GATE CURRENT

Test Circuit

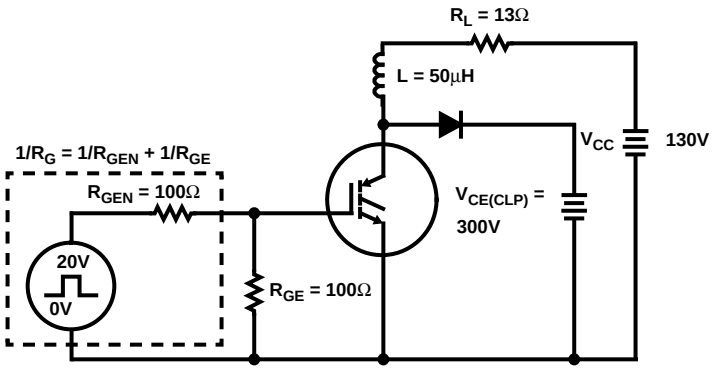


FIGURE 16. INDUCTIVE SWITCHING TEST CIRCUIT