HGTG40N60A4

Data Sheet August 2003

600V, SMPS Series N-Channel IGBT

The HGTG40N60A4 is a MOS gated high voltage switching device combining the best features of a MOSFET and a bipolar transistor. This device has the high input impedance of a MOSFET and the low on-state conduction loss of a bipolar transistor. The much lower on-state voltage drop varies only moderately between 25°C and 150°C. This IGBT is ideal for many high voltage switching applications operating at high frequencies where low conduction losses are essential. This device has been optimized for high frequency switch mode power supplies.

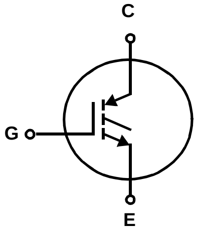
Formerly Developmental Type TA49347.

Ordering Information

PART NUMBER	PACKAGE	BRAND
HGTG40N60A4	TO-247	40N60A4

NOTE: When ordering, use the entire part number.

Symbol

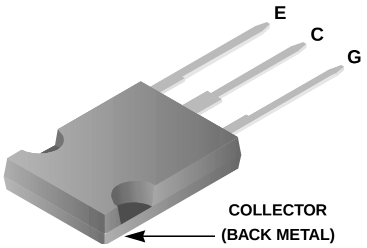


Features

- 100kHz Operation At 390V, 40A
- 200kHz Operation At 390V, 20A
- 600V Switching SOA Capability
- Typical Fall Time. . . . . .55ns at $T_J = 125^o$
- Low Conduction Loss

Packaging

JEDEC STYLE TO-247



FAIRCHILD 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

		HGTG40N60A4	UNITS
Collector to Emitter Voltage	BV_{CES}	600	V
Collector Current Continuous			
At $T_C = 25^oC$	I_{C25}	75	A
At $T_C = 110^oC$	I_{C110}	63	A
Collector Current Pulsed (Note 1)	I_{CM}	300	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	200A at 600V	
Power Dissipation Total at $T_C = 25^oC$	P_D	625	W
Power Dissipation Derating $T_C > 25^oC$		5	$W/^oC$
Operating and Storage Junction Temperature Range	T_J, T_{STG}	-55 to 150	^oC
Maximum Lead Temperature for Soldering	T_L	260	^oC

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.

NOTE:

1. Pulse width limited by maximum junction temperature.

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

PARAMETER	SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNITS
Collector to Emitter Breakdown Voltage	BV_{CES}	$I_C = 250\mu A$, $V_{GE} = 0V$		600	-	-	V
Emitter to Collector Breakdown Voltage	BV_{ECS}	$I_C = -10mA$, $V_{GE} = 0V$		20	-	-	
Collector to Emitter Leakage Current	I_{CES}	$V_{CE} = BV_{CES}$	$T_J = 25^oC$	-	-	250	µA
			$T_J = 125^oC$	-	-	3.0	mA
Collector to Emitter Saturation Voltage	$V_{CE(SAT)}$	$I_C = 40A$, $V_{GE} = 15V$	$T_J = 25^oC$	-	1.7	2.7	V
			$T_J = 125^oC$	-	1.5	2.0	V
Gate to Emitter Threshold Voltage	$V_{GE(TH)}$	$I_C = 250\mu A$, $V_{CE} = V_{GE}$		4.5	5.6	7	V
Gate to Emitter Leakage Current	I_{GES}	$V_{GE} = \pm 20V$		-	-	±250	nA
Switching SOA	SSOA	$T_J = 150^oC$, $R_G = 2.2\Omega$, $V_{GE} = 15V$ $L = 100\mu H$, $V_{CE} = 600V$		200	-	-	A
Gate to Emitter Plateau Voltage	V_{GEP}	$I_C = 40A$, $V_{CE} = 0.5\ BV_{CES}$		-	8.5	-	V
On-State Gate Charge	$Q_{g(ON)}$	$I_C = 40A$, $V_{CE} = 0.5\ BV_{CES}$	$V_{GE} = 15V$	-	350	405	nC
			$V_{GE} = 20V$	-	450	520	nC
Current Turn-On Delay Time	$t_{d(ON)I}$	IGBT and Diode at $T_J = 25^oC$ $I_{CE} = 40A$ $V_{CE} = 0.65\ BV_{CES}$ $V_{GE} = 15V$ $R_G = 2.2\Omega$ $L = 200\mu H$ Test Circuit (Figure 20)		-	25	-	ns
Current Rise Time	t_{rI}			-	18	-	ns
Current Turn-Off Delay Time	$t_{d(OFF)I}$			-	145	-	ns
Current Fall Time	t_{fI}			-	35	-	ns
Turn-On Energy (Note 3)	E_{ON1}			-	400	-	µJ
Turn-On Energy (Note 3)	E_{ON2}			-	850	-	µJ
Turn-Off Energy (Note 2)	E_{OFF}			-	370	-	µJ

Electrical Specifications $T_J = 25^oC$, 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 $T_J = 125^oC$ $I_{CE} = 40A$ $V_{CE} = 0.65\ BV_{CES}$ $V_{GE} = 15V$ $R_G = 2.2\Omega$ L = 200µH Test Circuit (Figure 20)	-	27	-	ns
Current Rise Time	t_{rI}		-	20	-	ns
Current Turn-Off Delay Time	$t_{d(OFF)I}$		-	185	225	ns
Current Fall Time	t_{fI}		-	55	95	ns
Turn-On Energy (Note 3)	E_{ON1}		-	400	-	µJ
Turn-On Energy (Note 3)	E_{ON2}		-	1220	1400	µJ
Turn-Off Energy (Note 2)	E_{OFF}		-	700	800	µJ
Thermal Resistance Junction To Case	$R_{\theta JC}$		-	-	0.2	$^oC/W$

NOTES:

2. 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.
3. Values for two Turn-On loss conditions are shown for the convenience of the circuit designer. E_{ON1} is the turn-on loss of the IGBT only. E_{ON2} is the turn-on loss when a typical diode is used in the test circuit and the diode is at the same T_J as the IGBT. The diode type is specified in Figure 20.

Typical Performance Curves Unless Otherwise Specified

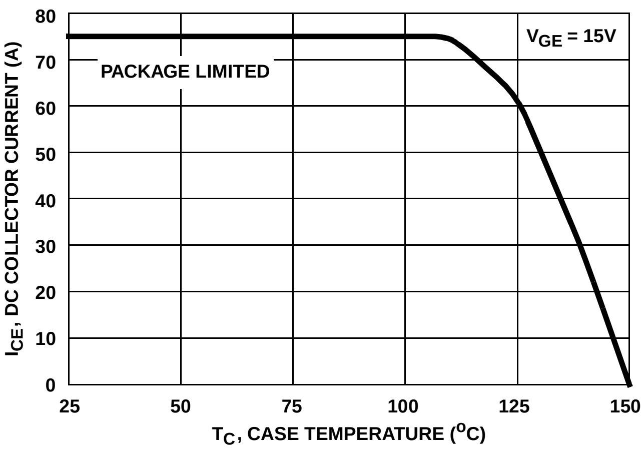


FIGURE 1. DC COLLECTOR CURRENT vs CASE TEMPERATURE

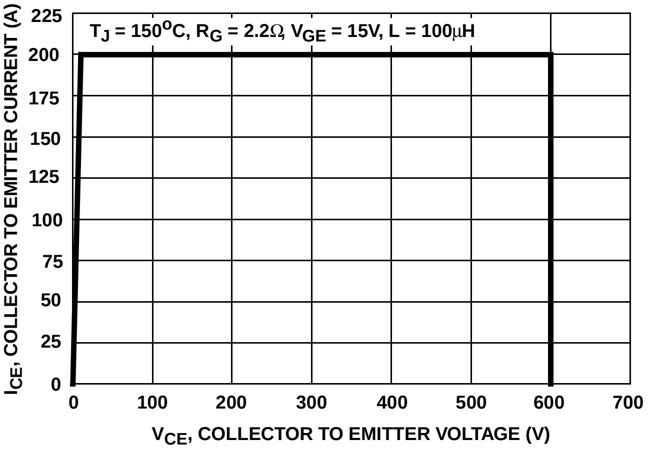


FIGURE 2. MINIMUM SWITCHING SAFE OPERATING AREA