Dec 2013

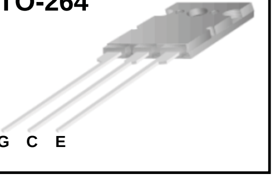
SemiHow
Know-How for Semiconductor

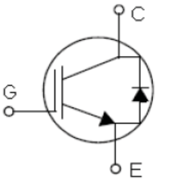
HIL40N120TF

1200V Field Stop Trench IGBT

V_{CES} = 1200 V
I_C = 40 A
$V_{CE(sat)\ typ}$ = 2.0 V

TO-264





FEATURES

- 1200V Field Stop Trench Technology
- High Speed Switching
- Low Conduction Loss
- Positive Temperature Coefficient
- Easy Parallel Operation

Absolute Maximum Ratings

Symbol	Parameter	Value	Units
V_{CES}	Collector-Emitter Voltage	1200	V
I_C	Collector Current – Continuous (T_C = 25℃)	80	A
	Collector Current – Continuous (T_C = 100℃)	40	A
I_{CM}	Collector Current – Pulsed (Note 1)	120	A
I_F	Diode Forward Current – Continuous (T_C = 25℃)	80	A
	Diode Forward Current – Continuous (T_C = 100℃)	40	A
I_{FM}	Diode Current – Pulsed (Note 1)	120	A
V_{GES}	Gate-Emitter Voltage	±20	V
P_D	Power Dissipation – Continuous (T_C = 25℃)	480	W
	Power Dissipation – Continuous (T_C = 100℃)	192	
T_J	Operating Temperature Range	-55 to +150	℃
T_{STG}	Storage Temperature Range	-55 to +150	℃
T_L	Maximum lead temperature for soldering purposes, 1/8” from case for 5 seconds	300	℃

Notes.
1. Pulse width limited by max junction temperature

Thermal Resistance Characteristics

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$(IGBT)	Junction-to-Case	--	0.26	℃/W
$R_{\theta JC}$(Diode)	Junction-to-Case	--	0.95	
$R_{\theta JA}$	Junction-to-Ambient	--	25	

Package Marking and Odering Information

Device Marking	Week Marking	Package	Packing	Quantity	RoHS Status
HIL40N120TF	YWWX	TO-264	Tube	25	Pb Free
HIL40N120TF	YWWXg	TO-264	Tube	25	Halogen Free

Electrical Characteristics of the IGBT T_C=25 °C unless otherwise specified

Symbol	Parameter	Test Conditions		Min	Typ	Max	Units
On Characteristics							
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$V_{CE} = V_{GE}$, $I_C = 40$ mA		4.5	6.5	8.5	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$V_{GE} = 15$ V, $I_C = 40$ A	$T_C = 25$℃	--	2.0	2.6	V
			$T_C = 125$℃	--	2.45	--	
Off Characteristics							
BV_{CES}	Collector-Emitter Breakdown Voltage	$V_{GE} = 0$ V, $I_C = 1$ mA		1200	--	--	V
I_{CES}	Zero Gate Voltage Collector Current	$V_{CE} = 1200$ V, $V_{GE} = 0$ V		--	--	1	mA
I_{GES}	Gate-Emitter Leakage Current	$V_{GE} = \pm20$ V, $V_{CE} = 0$ V		--	--	±250	nA
Dynamic Characteristics							
C_{iss}	Input Capacitance	$V_{CE} = 30$ V, $V_{GE} = 0$ V, f = 1.0 MHz		--	5150	--	pF
C_{oss}	Output Capacitance			--	150	--	pF
C_{rss}	Reverse Transfer Capacitance			--	100	--	pF
Switching Characteristics							
$t_{d(on)}$	Turn-On Time	$V_{CC} = 600$ V, $I_C = 40$ A, $R_G = 10$ Ω, $V_{GE} = 15$V Inductive load, $T_C = 25$℃		--	55	--	ns
t_r	Turn-On Rise Time			--	80	--	ns
$t_{d(off)}$	Turn-Off Delay Time			--	200	--	ns
t_f	Turn-Off Fall Time			--	55	110	ns
E_{on}	Turn-On Switching Loss			--	5.3	8.0	mJ
E_{off}	Turn-Off Switching Loss			--	1.1	1.6	mJ
E_{ts}	Total Switching Loss			--	6.4	9.6	mJ
$t_{d(on)}$	Turn-On Time	$V_{CC} = 600$ V, $I_C = 40$ A, $R_G = 10$ Ω, $V_{GE} = 15$V Inductive load, $T_C = 125$℃		--	45	--	ns
t_r	Turn-On Rise Time			--	75	--	ns
$t_{d(off)}$	Turn-Off Delay Time			--	210	--	ns
t_f	Turn-Off Fall Time			--	115	--	ns
E_{on}	Turn-On Switching Loss			--	5.6	8.4	mJ
E_{off}	Turn-Off Switching Loss			--	2.2	3.3	mJ
E_{ts}	Total Switching Loss			--	7.8	11.7	mJ
Q_g	Total Gate Charge	$V_{CC} = 600$V, $I_C = 40$ A, $V_{GE} = 15$ V		--	320	480	nC
Q_{ge}	Gate-Emitter Charge			--	40	60	nC
Q_{gc}	Gate-Collector Charge			--	150	225	nC

Electrical Characteristics of the Diode

V_{FM}	Diode Forward Voltage	I_F = 40 A	T_C = 25℃	--	2.85	3.35	V
			T_C = 125℃	--	2.9	--	
t_{rr}	Diode Reverse Recovery Time	I_F = 40 A, di/dt = 200 A/μs	T_C = 25℃	--	200	300	ns
			T_C = 125℃	--	325	--	
I_{rr}	Diode Peak Reverse Recovery Current		T_C = 25℃	--	23	35	A
			T_C = 125℃	--	43	--	
Q_{rr}	Diode Reverse Recovery Charge		T_C = 25℃	--	2500	--	nC
			T_C = 125℃	--	7000	--	

IGBT Characteristics

Fig. 1 Output characteristics

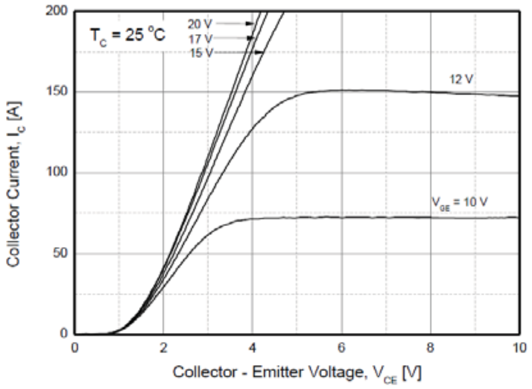


Fig. 2 Saturation voltage characteristics

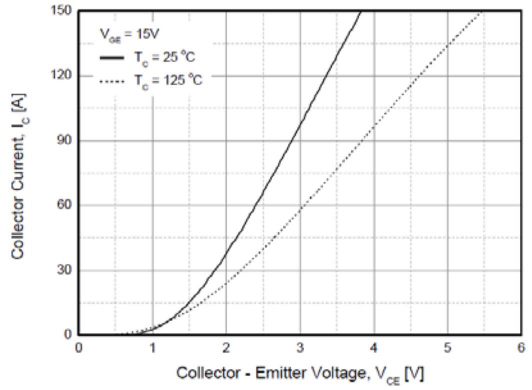


Fig. 3 Saturation voltage vs. collector current

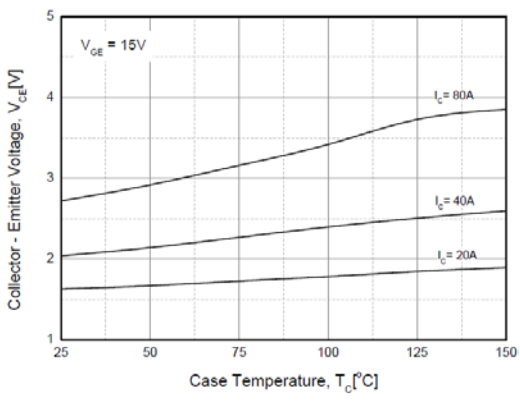


Fig. 4 Saturation voltage vs. gate bias

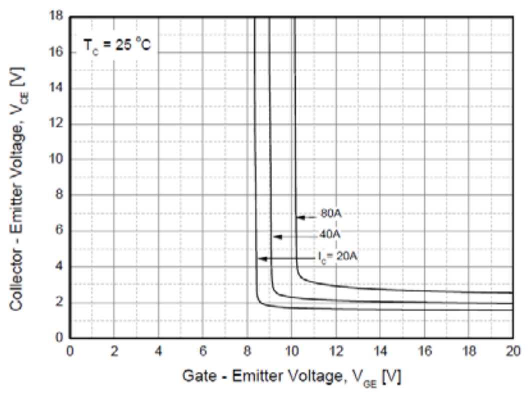


Fig. 5 Saturation voltage vs. gate bias

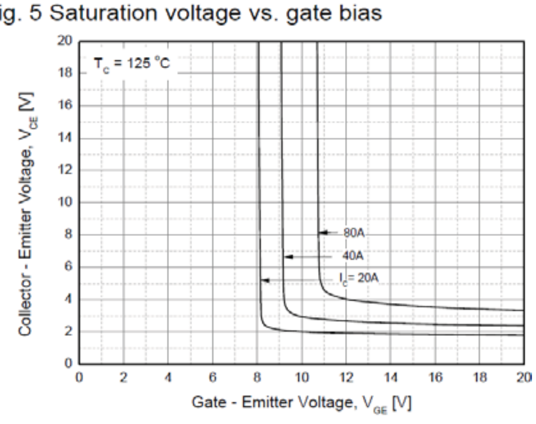
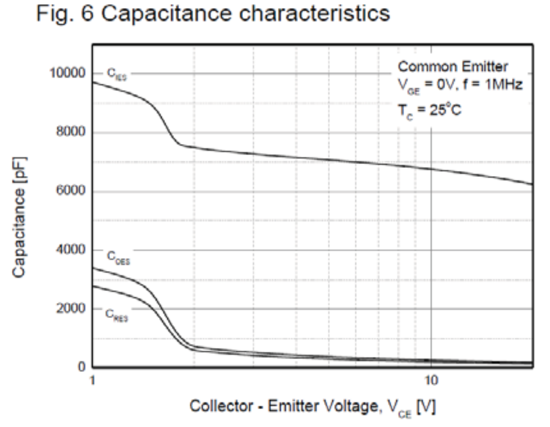


Fig. 6 Capacitance characteristics



IGBT Characteristics

Fig. 7 Turn-on time vs. gate resistor

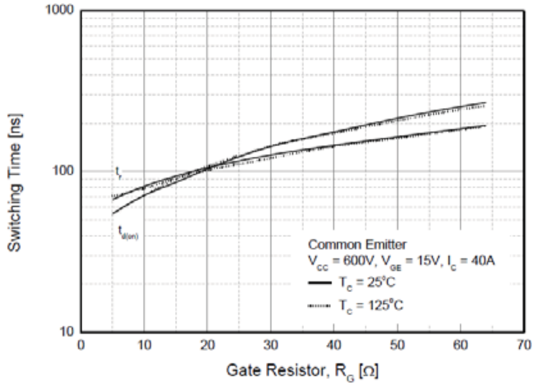


Fig. 8 Turn-off time vs. gate resistor

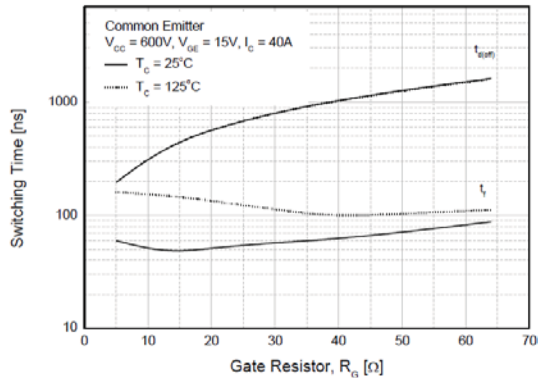


Fig. 9 Switching loss vs. gate resistor

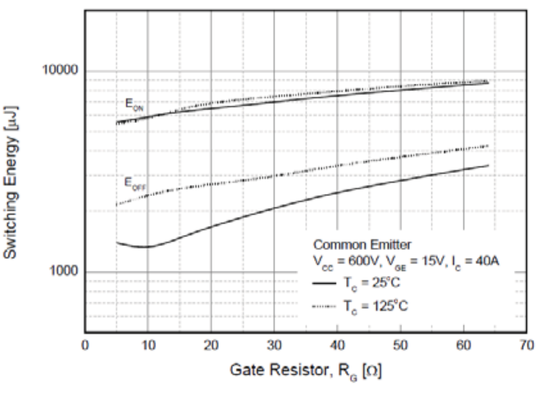


Fig. 10 Turn-on time vs. collector current

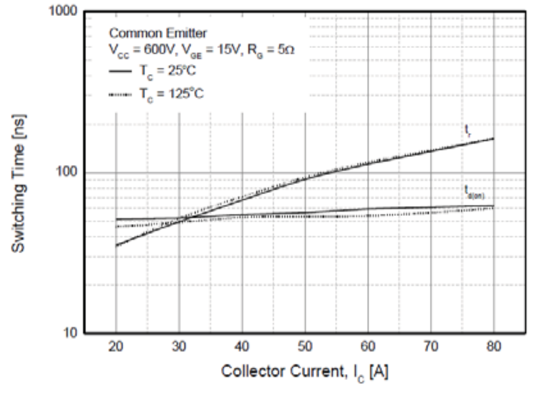


Fig. 11 Turn-off time vs. collector current

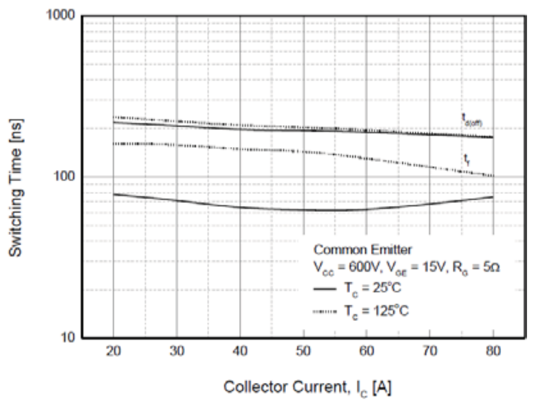
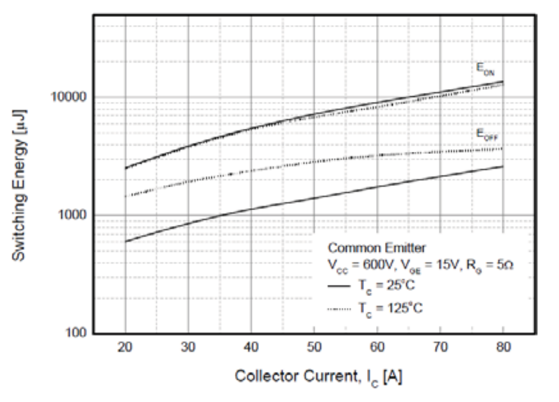


Fig. 12 Switching loss vs. collector current



IGBT Characteristics

Fig. 13 Gate charge characteristics

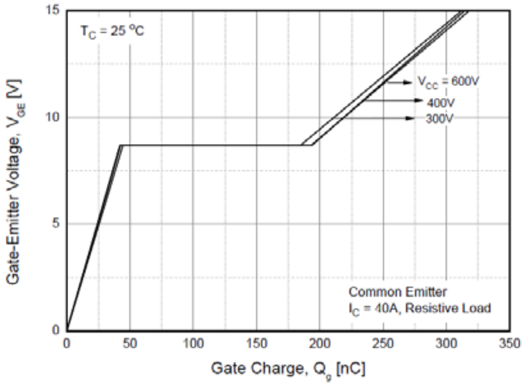


Fig. 14 SOA

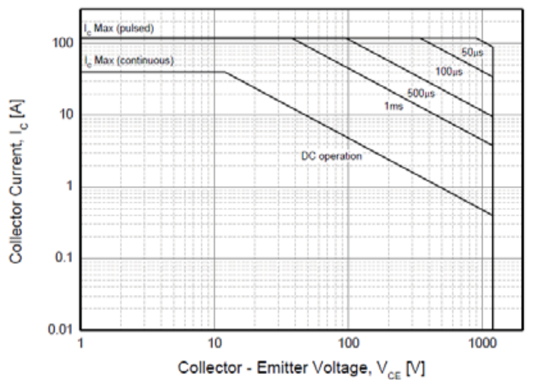


Fig. 15 RBSOA

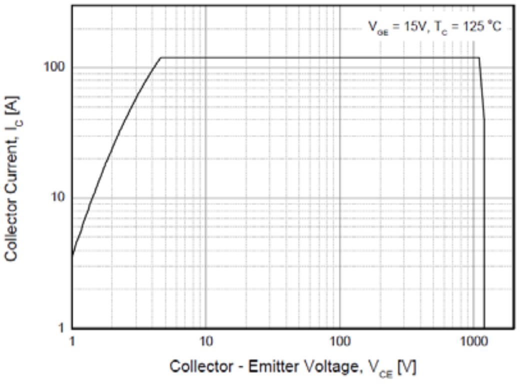


Fig. 16 Transient thermal impedance of IGBT

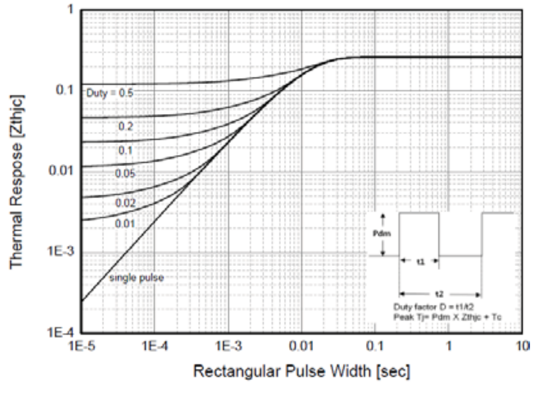
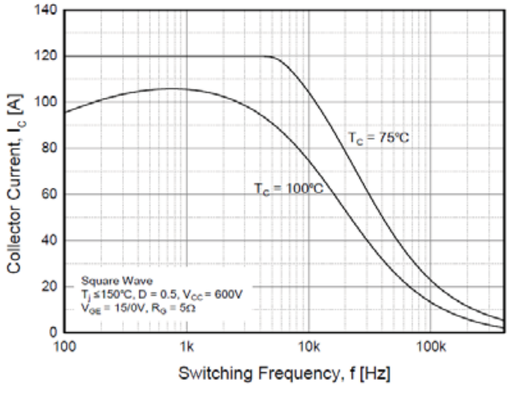


Fig. 17 Load Current vs. Frequency



Diode Characteristics

Fig. 18 Conduction characteristics

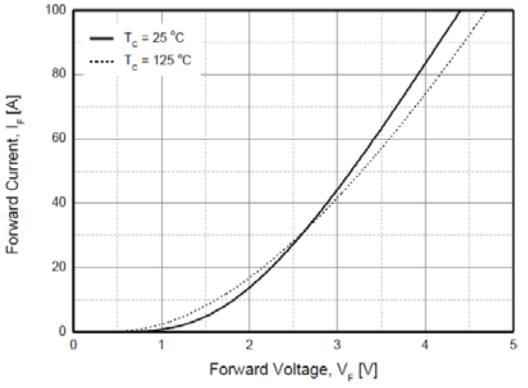


Fig. 19 Reverse recovery current vs. forward current

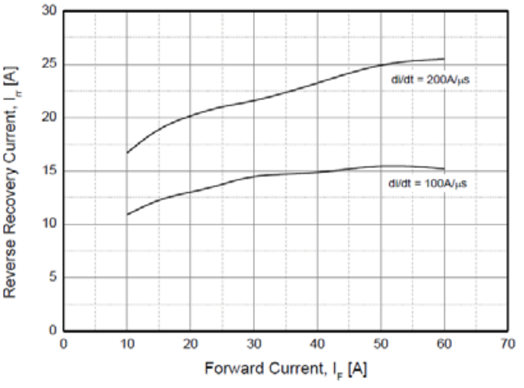


Fig. 20 Reverse recovery charge vs. forward current

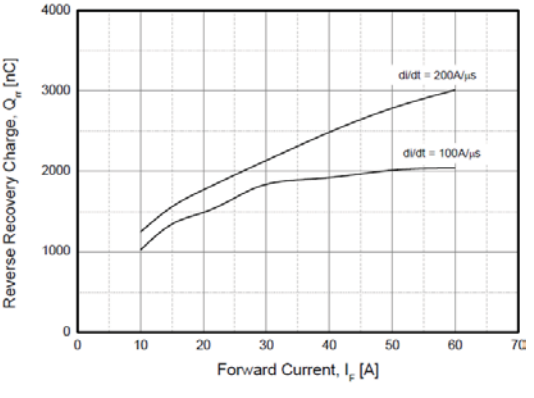
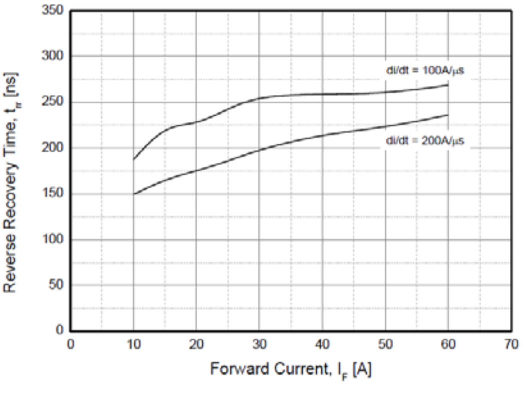


Fig. 21 Reverse recovery time vs. forward current



Package Dimension

TO-264