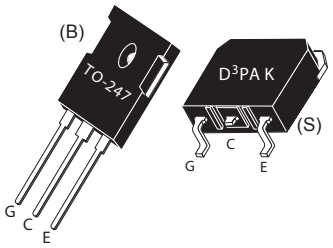
APT40GR120B
APT40GR120S

1200V, 40A, $V_{CE(on)}$= 2.5V Typical

Ultra Fast NPT - IGBT®



The Ultra Fast NPT - IGBT® is a new generation of high voltage power IGBTs. Using Non-Punch-Through Technology, the Ultra Fast NPT-IGBT® offers superior ruggedness and ultrafast switching speed.

Features

- **Low Saturation Voltage**
- **Low Tail Current**
- **RoHS Compliant**
- **Short Circuit Withstand Rated**
- **High Frequency Switching to 50KHz**
- **Ultra Low Leakage Current**

Unless stated otherwise, Microsemi discrete IGBTs contain a single IGBT die. This device is recommended for applications such as induction heating (IH), motor control, general purpose inverters and uninterruptible power supplies (UPS).

MAXIMUM RATINGS

All Ratings: T_C = 25°C unless otherwise specified.

Symbol	Parameter	Ratings	Unit
V_{ces}	Collector Emitter Voltage	1200	V
V_{GE}	Gate-Emitter Voltage	±30	
I_{C1}	Continuous Collector Current @ T_C = 25°C	88	A
I_{C2}	Continuous Collector Current @ T_C = 100°C	40	
I_{CM}	Pulsed Collector Current ①	160	
SCWT	Short Circuit Withstand Time: V_{CE} = 600V, V_{GE} = 15V, T_C=125°C	10	µs
P_D	Total Power Dissipation @ T_C = 25°C	500	W
T_J,T_{STG}	Operating and Storage Junction Temperature Range	-55 to 150	°C
T_L	Max. Lead Temp. for Soldering: 0.063" from Case for 10 Sec.	300	

STATIC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Min	Typ	Max	Unit
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage (V_{GE} = 0V, I_C = 1.0mA)	1200			Volts
$V_{GE(TH)}$	Gate Threshold Voltage (V_{CE} = V_{GE}, I_C = 2.0mA, T_j = 25°C)	3.5	5.0	6.5	
$V_{CE(ON)}$	Collector-Emitter On Voltage (V_{GE} = 15V, I_C = 40A, T_j = 25°C)		2.5	3.2	
	Collector-Emitter On Voltage (V_{GE} = 15V, I_C = 40A, T_j = 125°C)		3.5		
	Collector-Emitter On Voltage (V_{GE} = 15V, I_C = 88A, T_j = 25°C)		3.2		
I_{CES}	Collector Cut-off Current (V_{CE} = 1200V, V_{GE} = 0V, T_j = 25°C) ②		10	1000	µA
	Collector Cut-off Current (V_{CE} = 1200V, V_{GE} = 0V, T_j = 125°C) ②		100		
I_{GES}	Gate-Emitter Leakage Current (V_{GE} = ±20V)			±250	nA

CAUTION: These Devices are Sensitive to Electrostatic Discharge. Proper Handling Procedures Should Be Followed.

DYNAMIC CHARACTERISTICS

APT40GR120B_S

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
C_{ies}	Input Capacitance	Capacitance		3980		pF
C_{oes}	Output Capacitance	V_{GE} = 0V, V_{CE} = 25V		320		
C_{res}	Reverse Transfer Capacitance	f = 1MHz		80		
V_{GEP}	Gate to Emitter Plateau Voltage	Gate Charge		7		V
Q_g ③	Total Gate Charge	V_{GE} = 15V		210		nC
Q_{ge}	Gate-Emitter Charge	V_{CE}= 600V		25		
Q_{gc}	Gate- Collector Charge	I_C = 40A		90		
$t_{d(on)}$	Turn-On Delay Time	Inductive Switching (25°C)		22		ns
t_r	Current Rise Time	V_{CC} = 600V		25		
$t_{d(off)}$	Turn-Off Delay Time	V_{GE} = 15V		163		
t_f	Current Fall Time	I_C = 40A		40		
E_{on2} ⑤	Turn-On Switching Energy	R_G = 4.3 Ω④		1375	3000	µJ
E_{off} ⑥	Turn-Off Switching Energy	T_J = +25°C		906	1650	
$t_{d(on}$	Turn-On Delay Time	Inductive Switching (125°C)		22		ns
t_r	Current Rise Time	V_{CC} = 600V		25		
$t_{d(off)}$	Turn-Off Delay Time	V_{GE} = 15V		185		
t_f	Current Fall Time	I_C = 40A		47		
E_{on2} ⑤	Turn-On Switching Energy	R_G = 4.3 Ω④		1916	3500	µJ
E_{off} ⑥	Turn-Off Switching Energy	T_J = +125°C		1186	2500	

THERMAL AND MECHANICAL CHARACTERISTICS

Symbol	Characteristic	Min	Typ	Max	Unit
$R_{\theta JC}$	Junction to Case Thermal Resistance			.25	°C/W
$R_{\theta JA}$	Junction to Ambient Thermal Resistance			40	
W_T	Package Weight		.22		oz
			6.2		g
Torque	Mounting Torque (TO-247 Package), 4-40 or M3 screw			10	in-lbf
				6.2	N·m

1 Repetitive Rating: Pulse width and case temperature limited by maximum junction temperature.

2 Pulse test: Pulse Width < 380*µs*, duty cycle < 2%.

3 See Mil-Std-750 Method 3471.

4 R_G is external gate resistance, not including internal gate resistance or gate driver impedance. (MIC4452)

5 E_{on2} is the clamped inductive turn on energy that includes a commutating diode reverse recovery current in the IGBT turn on energy loss. A combi device is used for the clamping diode.

6 E_{off} is the clamped inductive turn-off energy measured in accordance with JEDEC standard JESD24-1.

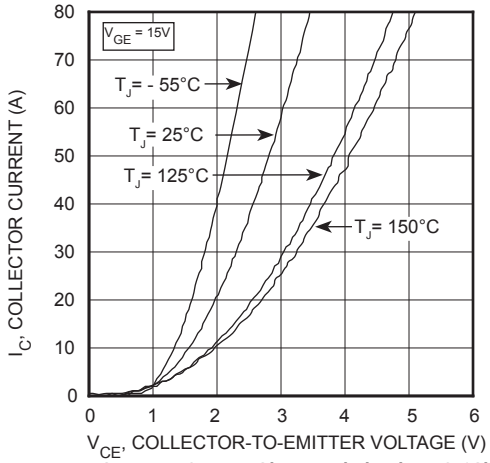


FIGURE 1, Output Characteristics (T_J = 25°C)

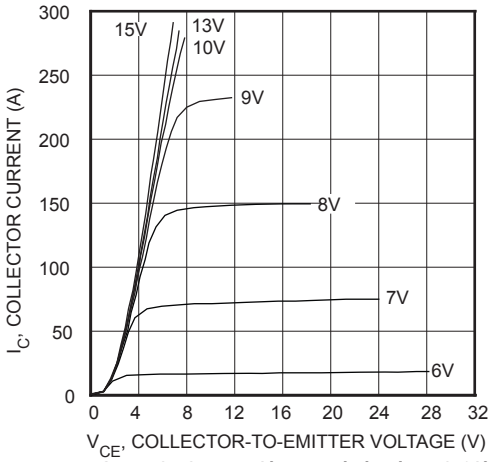


FIGURE 2, Output Characteristics (T_J = 25°C)

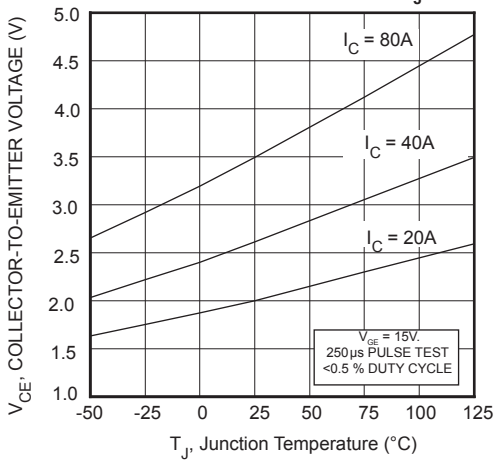


FIGURE 3, On State Voltage vs Junction Temperature

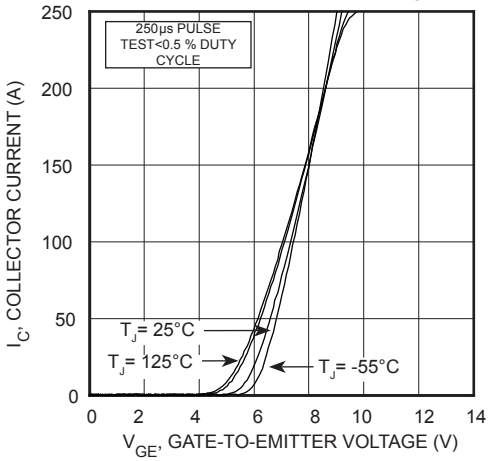


FIGURE 4, Transfer Characteristics

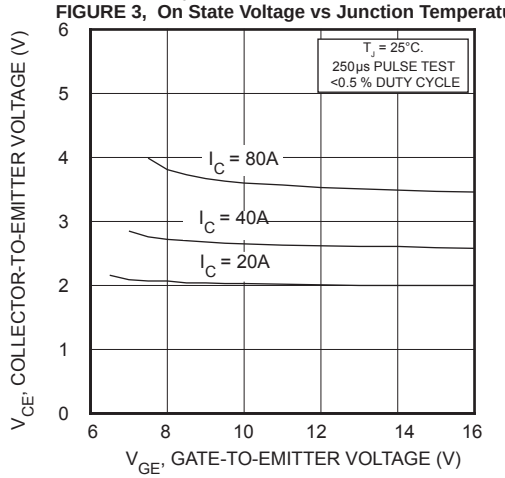


FIGURE 5, On State Voltage vs Gate-to-Emitter Voltage

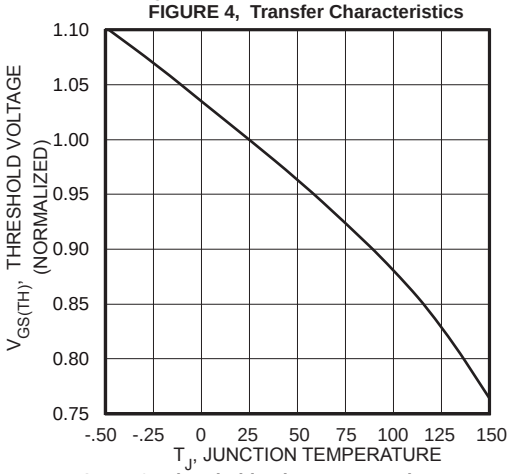


FIGURE 6, Threshold Voltage vs Junction Temperature

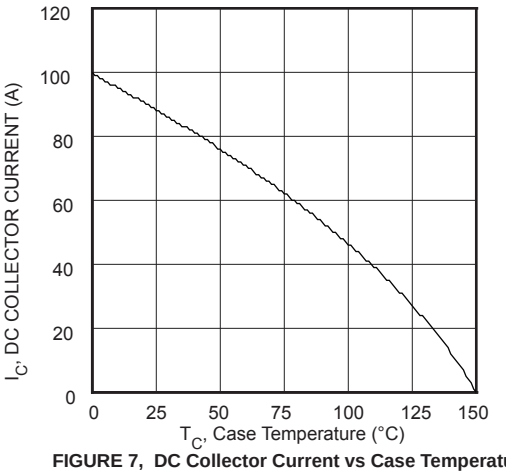


FIGURE 7, DC Collector Current vs Case Temperature

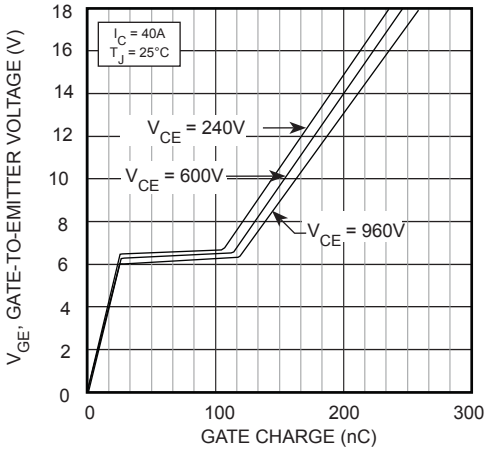


FIGURE 8, Gate charge

TYPICAL PERFORMANCE CURVES

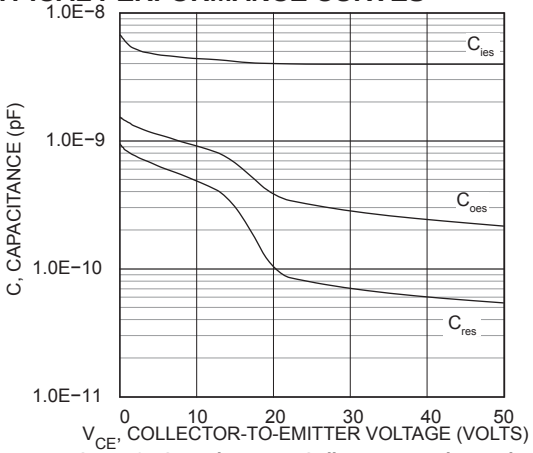


FIGURE 9, Capacitance vs Collector-To-Emitter Voltage

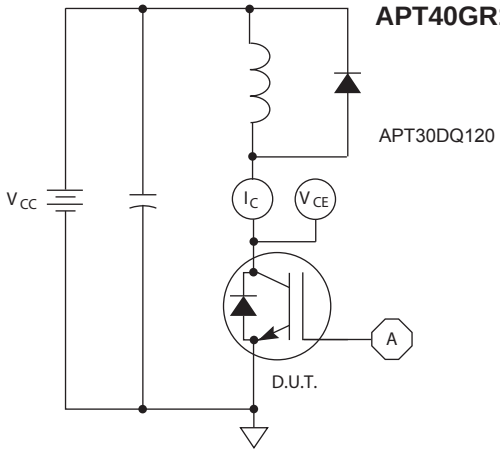


FIGURE 10, Inductive Switching Test Circuit

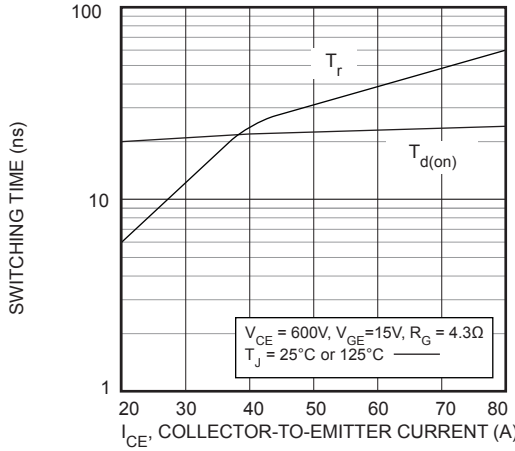


FIGURE 11, Turn-On Time vs Collector Current

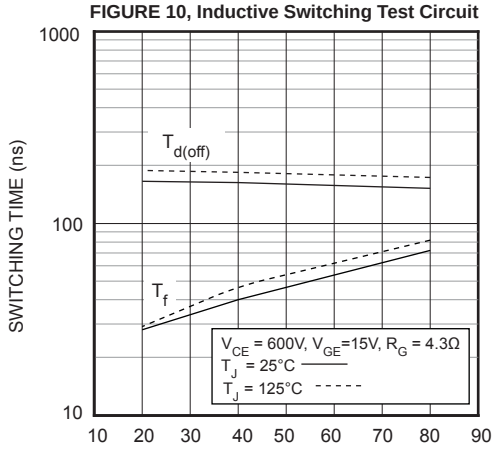


FIGURE 12, Turn-Off Time vs Collector Current

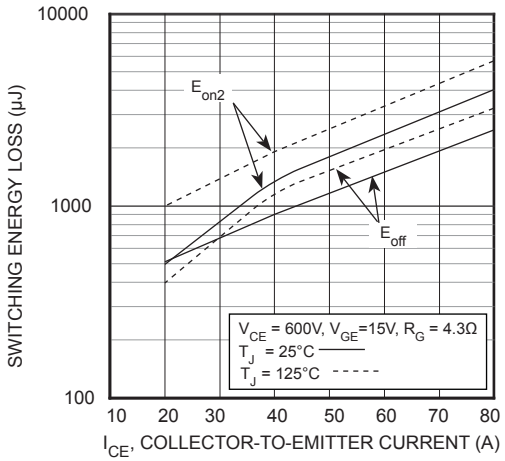


FIGURE 13, Energy Loss vs Collector Current

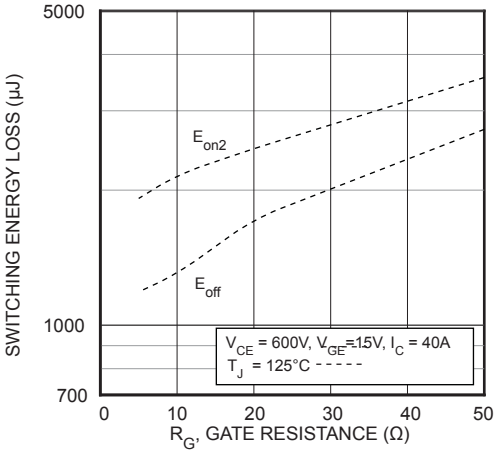


FIGURE 14, Energy Loss vs Gate Resistance

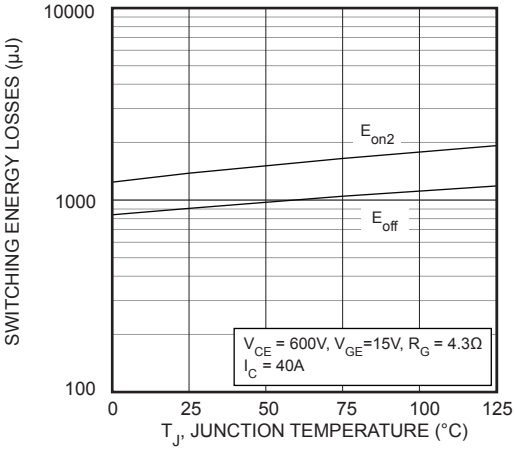


FIGURE 15, Energy Losses vs Junction Temperature

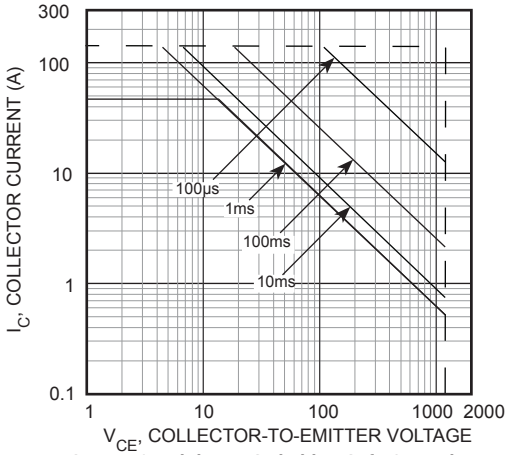


FIGURE 16, Minimum Switching Safe Operating Area