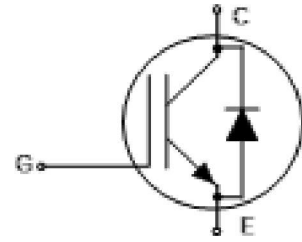


# AP40T120WHKH IGBT

## Feature

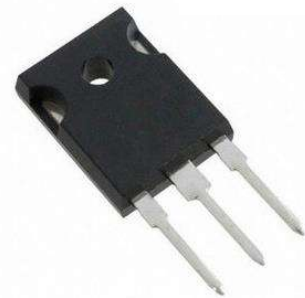
- 1200V,40A
- $V_{CE(sat)(typ.)}=2.1V@V_{GE}=15V,I_C=40A$
- High speed Switching
- Higher system efficiency
- Soft current turn-off waveforms
- Pb-free Lead Plating;RoHS Compliant



## Application

- Frequency Converters
- Air Conditioning
- Uninterrupted Power Supply
- Motor Drives

TO-247-3L



## Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity (PCS)
40T120WHKH	AP40T120WHKH	TO-247-3L	-	-	-

## Package Maximum Rated values

Parameter	Symbol	Note or test condition	Value			Unit
			Min	Typ	Max	
Storage temperature	Tstg		-55	-	150	°C
Soldering temperature		Wave soldering .6mm(0.063in.) from case for 10s	-	-	260	°C
Thermal resistance, junction-ambient	R <sub>thjA</sub>		-	-	40	K/W

## Maximum Rated values

Parameter	Symbol	Note or test condition	Value	Unit
Collector-emitter Voltage	V <sub>CE</sub>	T <sub>VJ</sub> ≥ 25°C	1200	V
DC collector current, limited by T <sub>jmax</sub>	I <sub>C</sub>	T <sub>C</sub> = 25°C value limited by bondwire	80	A
		T <sub>C</sub> = 100°C	40	A
Pulsed collector current	I <sub>Cplus</sub>	limited by T <sub>jmax</sub>	120	A
Gate-emitter voltage	V <sub>GE</sub>		±30	V
Diode continuous Forward Current (T <sub>C</sub> = 100°C)	I <sub>F</sub>		40	A
Diode Maximum Forward Current	I <sub>FM</sub>	limited by T <sub>jmax</sub>	120	A
Short Circuit Withstand Time	t <sub>sc</sub>		10	us
Power dissipation	P <sub>tot</sub>	T <sub>C</sub> = 25°C	300	W
		T <sub>C</sub> = 100°C	110	W

**IGBT Characteristic values**

Parameter	Symbol	Note or test condition	Value			Unit
			Min	Typ	Max	
Collector-emitter saturation voltage	$V_{CE\ sat}$	$I_C = 40.0\ A, V_{GE} = 15\ V, T_j = 25\ ^\circ C$	-	2.1	-	V
Gate-emitter threshold voltage	$V_{GEth}$	$I_C = 250\ \mu A, V_{CE} = V_{GE}, T_j = 25\ ^\circ C$	4.5	-	6.5	V
Collector-Emitter Leakage current	$I_{CES}$	$V_{CE} = 1200\ V, V_{GE} = 0\ V, T_j = 25\ ^\circ C$	-	-	100	$\mu A$
Gate-emitter leakage current	$I_{GES}$	$V_{CE} = 0\ V, V_{GE} = \pm 30\ V$	-	-	$\pm 100$	nA
Input capacitance	$C_{ies}$	$V_{CE} = 25\ V, V_{GE} = 0\ V, f = 1\ MHz$	-	4000	-	pF
Output capacitance	$C_{oes}$		-	200	-	pF
Reverse transfer capacitance	$C_{res}$		-	150	-	pF
Gate charge	$Q_G$	$I_C = 40.0\ A, V_{GE} = 15\ V, V_{CE} = 600\ V$	-	175	-	nC
Gate-Emitter Charge	$Q_{GE}$		-	52.5	-	nC
Gate-Collector Charge	$Q_{GC}$		-	107.5	-	nC
Turn-on delay time	$t_{don}$	$V_{CE} = 600\ V, V_{GE} = 15\ V,$ $R_{Gon} = 15\ \Omega, R_{Goff} = 15\ \Omega,$ $T_{vj} = 25\ ^\circ C, I_C = 40\ A$	-	58	-	ns
Rise time	$t_r$		-	86	-	ns
Turn-off delay time	$t_{doff}$		-	235	-	ns
Fall time	$t_f$		-	136	-	ns
Turn-on energy	$E_{on}$		-	2.5	-	mJ
Turn-off energy	$E_{off}$		-	1.7	-	mJ
Total switch energy	$E_{ts}$		-	4.2	-	mJ
IGBT thermal resistance, junction-case	$R_{thjc}$		-	-	0.42	K/W
Operating junction temperature	$T_j$	-40	-	175	$^\circ C$	

**Diode Characteristic values**

Parameter	Symbol	Note or test condition	Value			Unit
			Min	Typ	Max	
Diode forward voltage	$V_F$	$I_F = 40.0\ A, T_{vj} \geq 25\ ^\circ C$	-	2.2	3.2	V
Reverse leakage current	$t_{rr}$	$V_R = 600\ V, R_{gon} = 12\ \Omega,$ $I_F = 40\ A, T_{vj} \geq 25\ ^\circ C$	-	250	-	ns
Diode reverse recovery charge	$Q_{rr}$		-	1.35	-	$\mu C$
Diode peak reverse recovery current	$I_{rrm}$		-	10	-	A
Diode thermal resistance, junction-case	$R_{thjc}$	-	-	0.8	K/W	
Diode thermal resistance, junction-case	$T_j$	-40	-	175	$^\circ C$	

### Typical Performance Characteristics

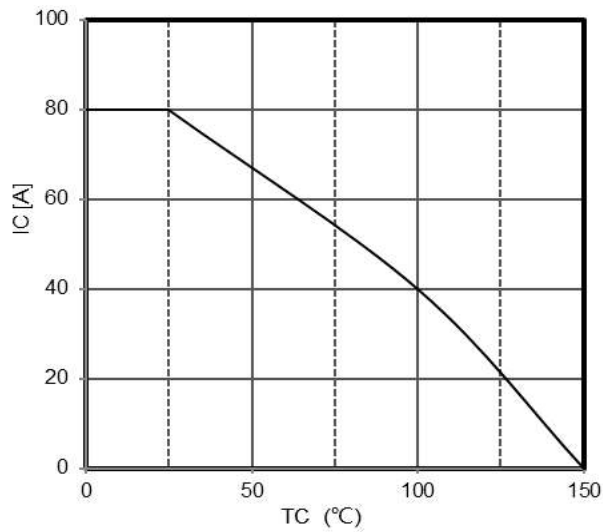


Figure1:maximum DC collector current VS. case temperature

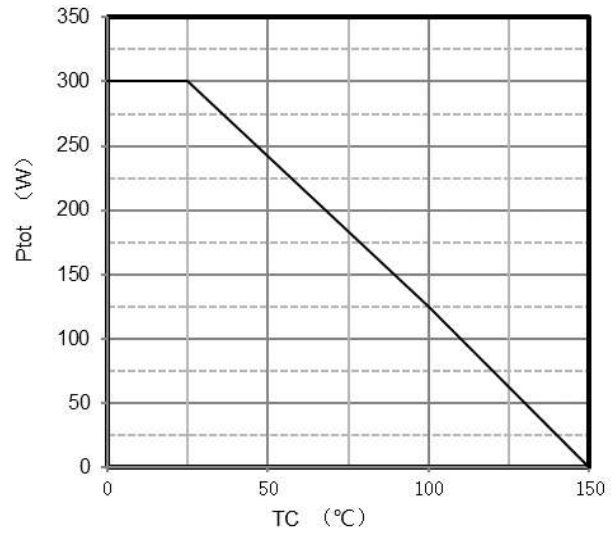


Figure2:power dissipation VS. case temprature

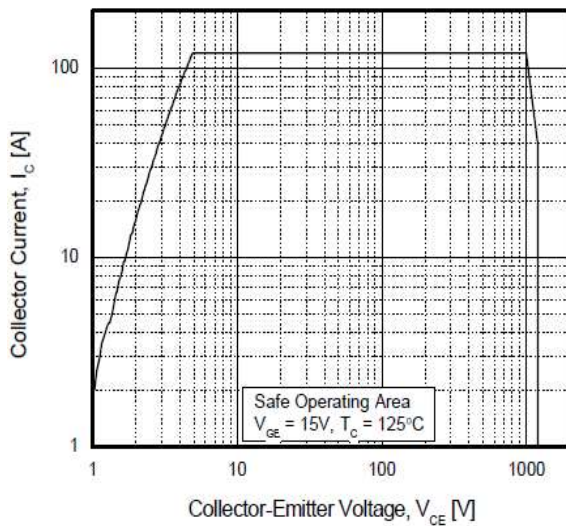


Figure3:reverse bias SOA, T<sub>J</sub>=125°C, V<sub>GE</sub>=15V

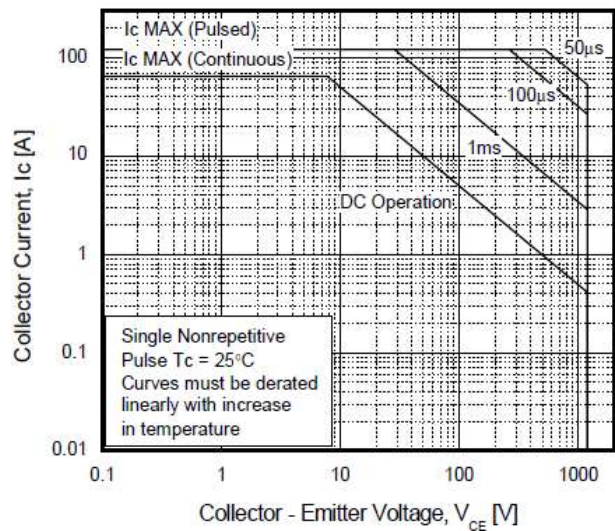


Figure4:forward SOA, T<sub>C</sub>=25°C, T<sub>J</sub>≤150°C

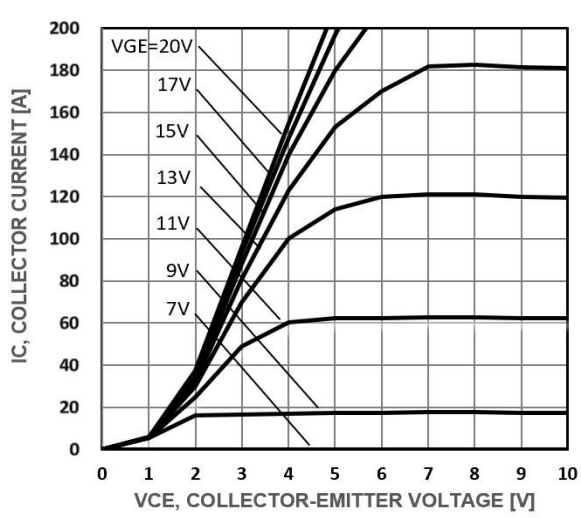


Figure5: typical IGBT output characteristics,  
 $T_J=25^{\circ}\text{C}; t_p=300\mu\text{s}$

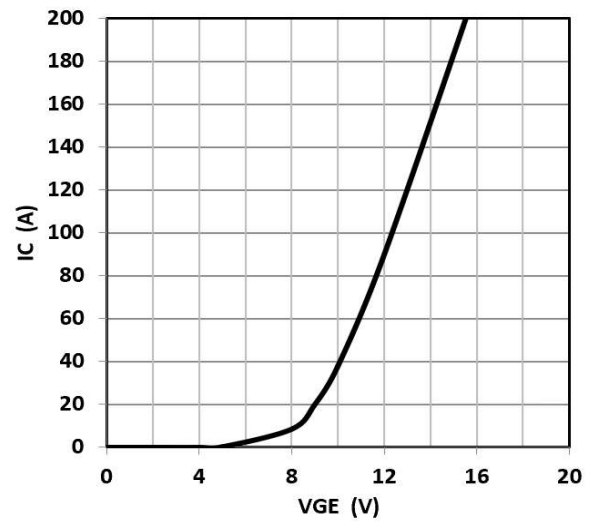


Figure6: typical trans characteristics,  
 $V_{CE}=20\text{V}, t_p=20\mu\text{s}$

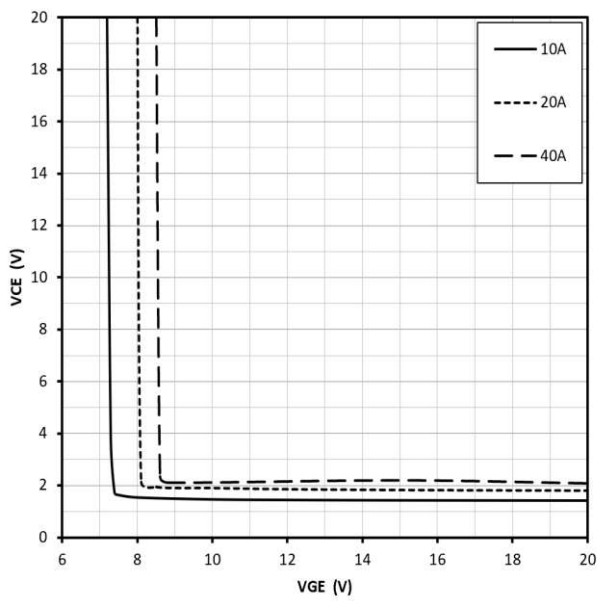


Figure7: typical VCE VS. VGE,  $T_J=25^{\circ}\text{C}$

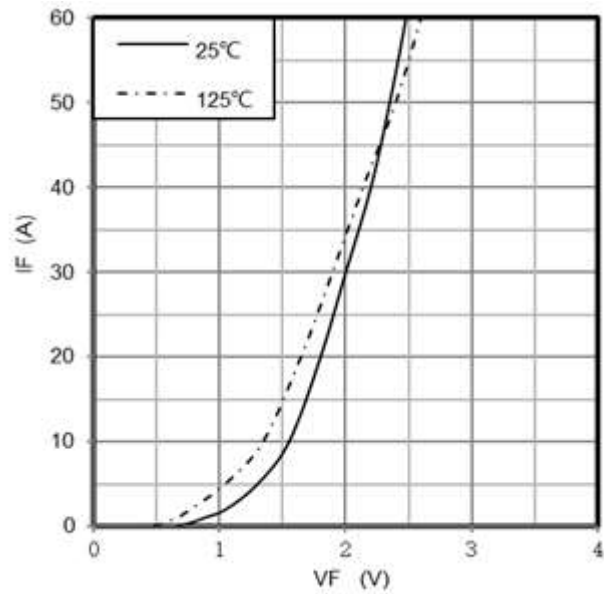


Figure8: typical diode forward characteristic,  $t_p=300\mu\text{s}$

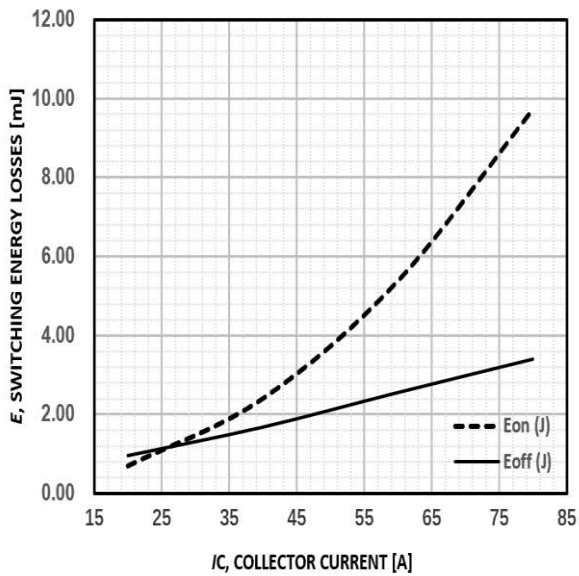


Figure9: typical energy loss VS. IC, TC=25°C,  
L=500uH , VCE=600V,VGE=15V,Rg=15Ω

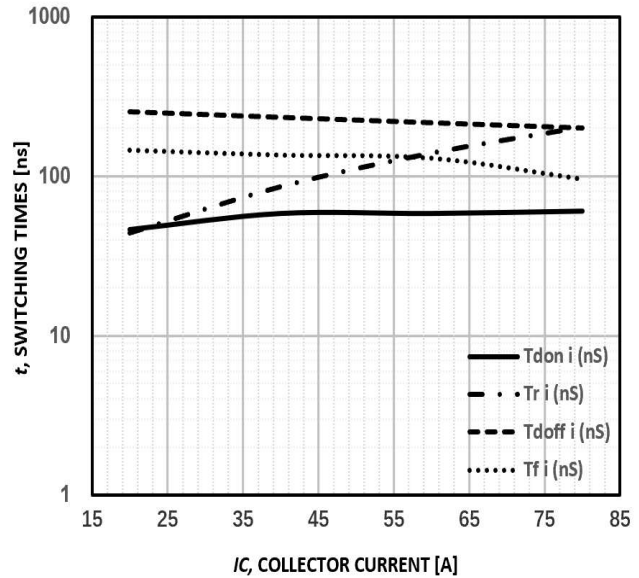


Figure10: typical switching time VS. IC, TC=25°C,  
L=500uH, VCE=600V,VGE=15V,Rg=15Ω

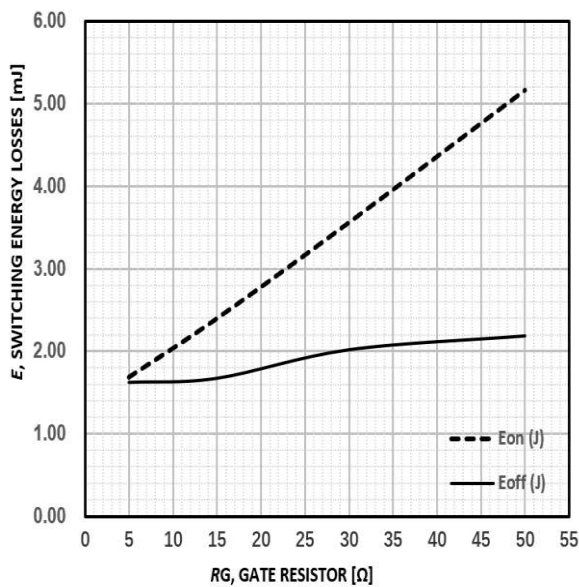


Figure11: typical energy loss VS. Rg,TC=25°C,  
L=500uH, VCE=600V, VGE=15V ,IC=40A

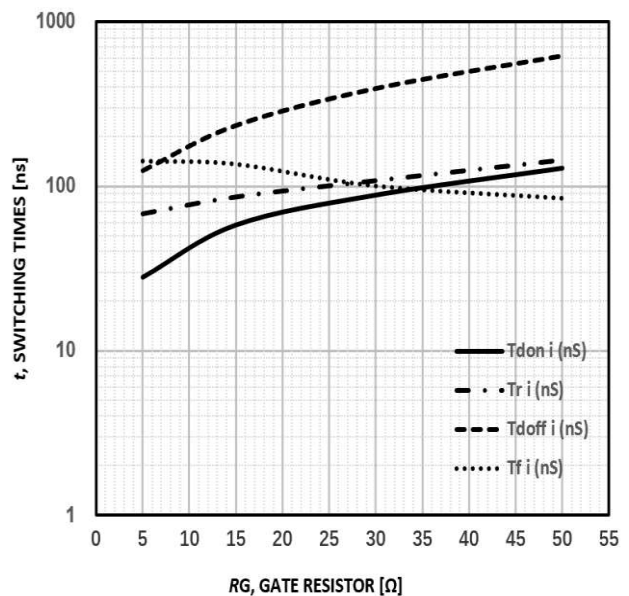


Figure12: typical switching time VS. Rg,TC=25°C,  
L=500uH,VCE=600V,VGE=15V,IC=40A



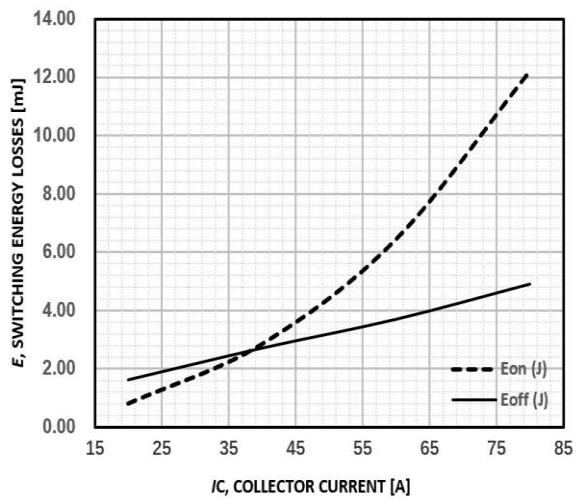


Figure13: typical energy loss VS. IC, TC=175°C,  
L=500uH , VCE=600V, VGE=15V, Rg=15Ω

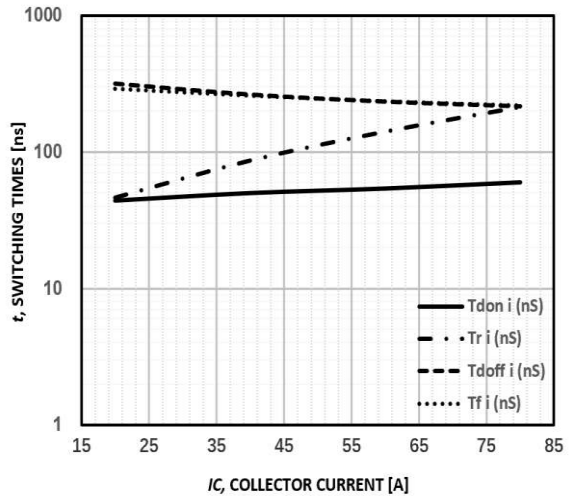


Figure14: typical switching time VS. IC, TC=175°C,  
L=500uH, VCE=600V, VGE=15V, Rg=15Ω

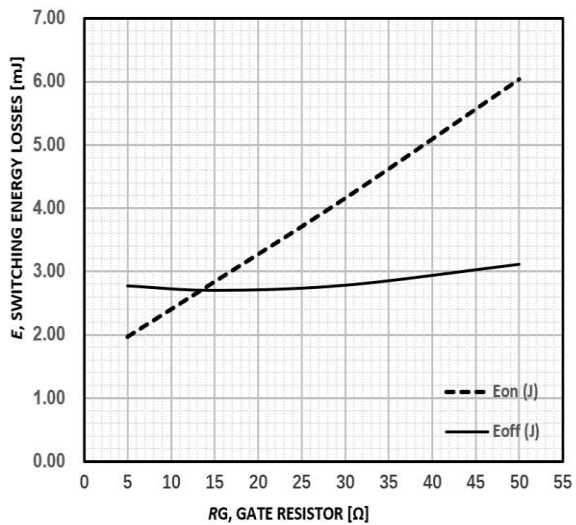


Figure15: typical energy loss VS. Rg, TC=175°C,  
L=500uH, VCE=600V, VGE=15V, IC=40A

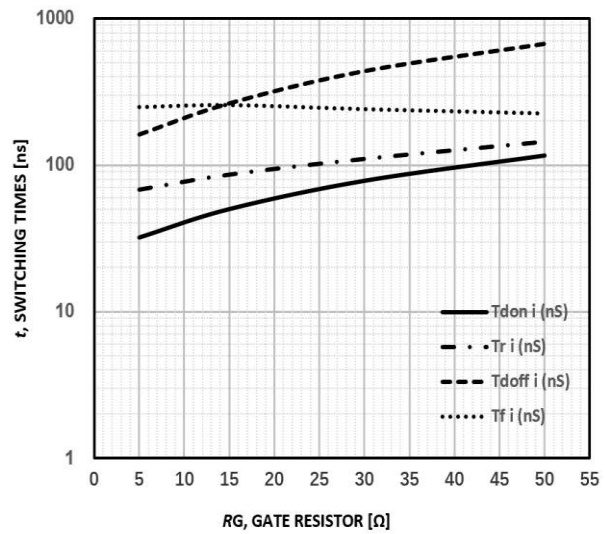


Figure16: typical switching time VS. Rg, TC=175°C,  
L=500uH, VCE=600V, VGE=15V, IC=40A

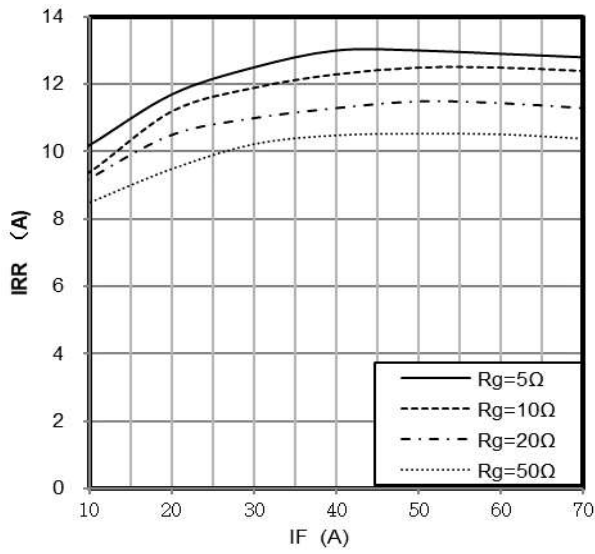


Figure17: typical diode IRR VS. IF, TC=25°C  
VCC=600V, VGE=15V

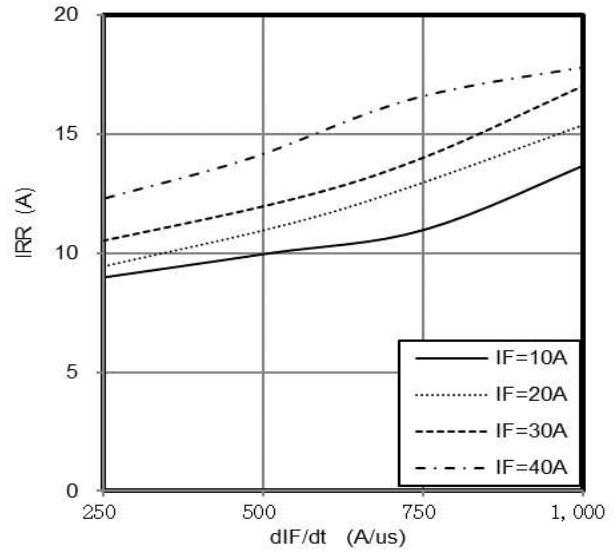


Figure18: typical diode IRR VS. dIF/dt  
VCC=600V, VGE=15V

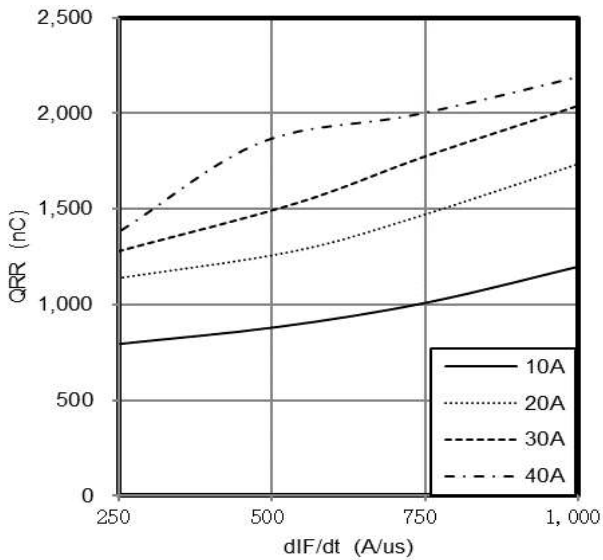


Figure19: typical diode QRR VS. dIF/dt  
VCC=600V , VGE=15V

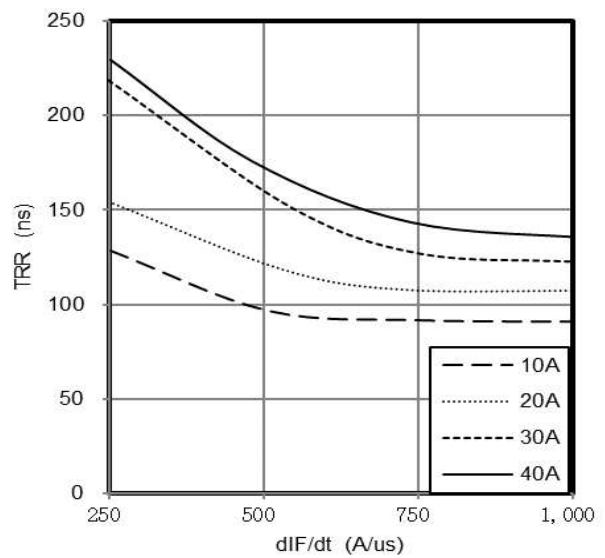


Figure20: typical diode TRR VS. dIF/dt,  
VCC=600V, VGE=15V

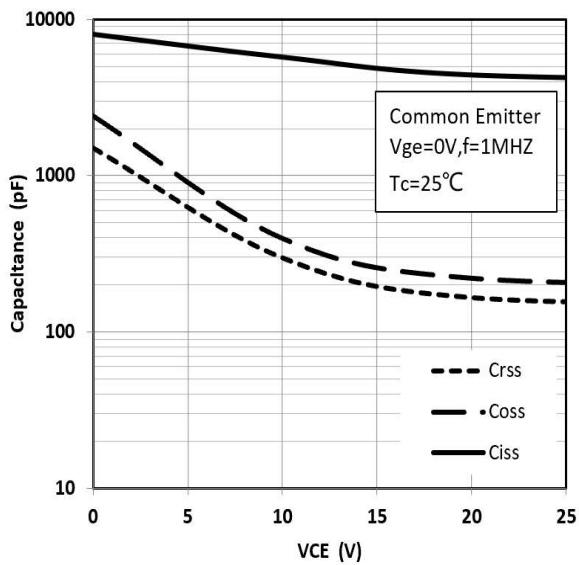


Figure21:typical capacitance VS. VCE,  
VGE=0V,f=100kHz

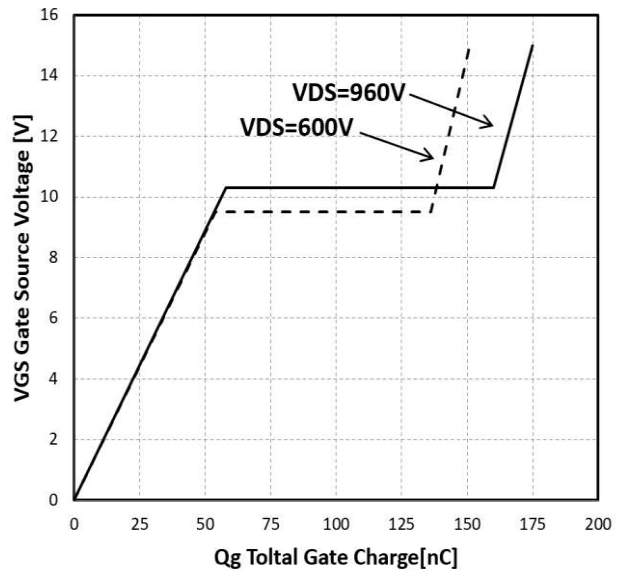


Figure22:typical gate charge VS. VGE,IC=40A

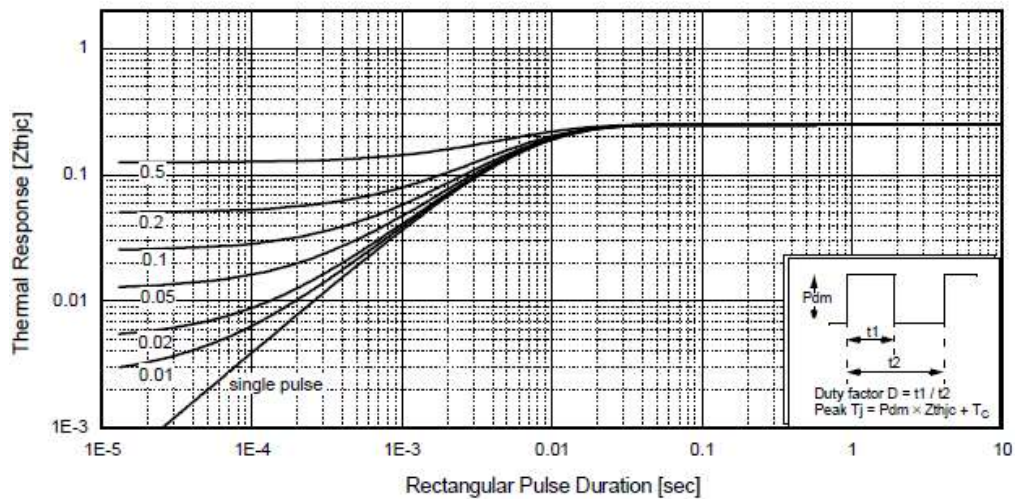
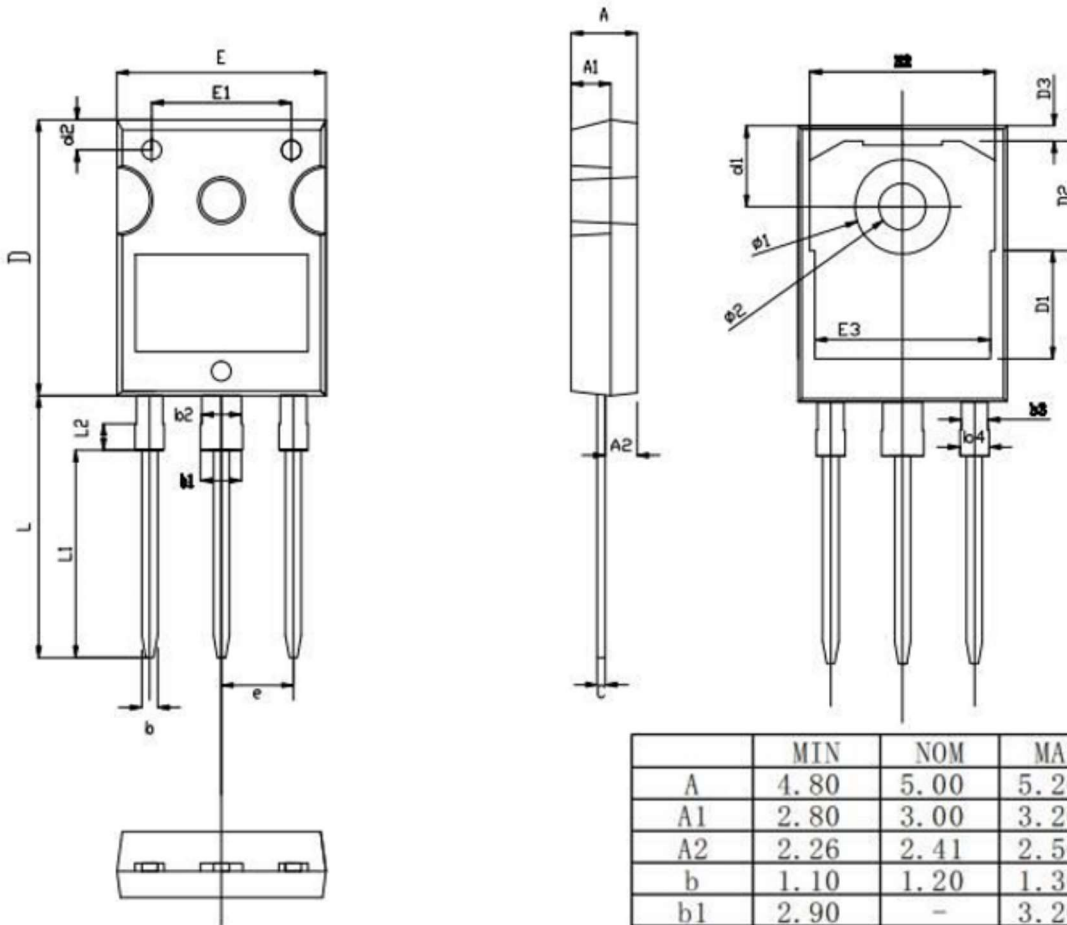


Figure23: normalized transient thermal impedance, junction-to-case

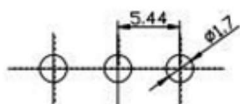
Note1.Duty factor  $D=t1/t2$  Note2: peak  $TJ=PDM \times Zthjc + TC$



TO-247-3L PACKAGE OUTLINE



RECOMMENDED LAND PATTERN



UNIT: mm

	MIN	NOM	MAX
A	4.80	5.00	5.20
A1	2.80	3.00	3.20
A2	2.26	2.41	2.56
b	1.10	1.20	1.30
b1	2.90	-	3.20
b2	2.90	3.00	3.10
b3	1.90	2.00	2.10
b4	2.00	-	2.20
c	0.50	0.60	0.70
D	20.80	21.00	21.20
D1		8.23	
D2		8.32	
D3		1.17	
d1	6.00	6.15	6.30
d2	2.20	2.30	2.40
E	15.60	15.80	16.00
E1		10.50	
E2		14.02	
E3		13.50	
e	5.34	5.44	5.54
L	19.72	19.92	20.12
L1		15.79	
L2		1.98	
ø1	7.10	7.19	7.30
ø2	3.50	3.60	3.70