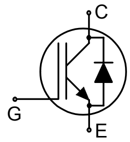
IHW40N60T

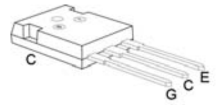
Soft Switching Series

Low Loss DuoPack : IGBT in TrenchStop® -technology with anti-parallel diode

Features:



- Very low $V_{CE(sat)}$ 1.5 V (typ.)
- Maximum Junction Temperature 175 °C
- Short circuit withstand time – 5µs
- TrenchStop® and Fieldstop technology for 600 V applications offers :
  - very tight parameter distribution
  - high ruggedness, temperature stable behavior
  - low $V_{CE(sat)}$
- Positive temperature coefficient in $V_{CE(sat)}$
- Low EMI
- Low Gate Charge
- Qualified according to JEDEC[1] for target applications
- Pb-free lead plating; RoHS compliant
- Complete product spectrum and PSpice Models : http://www.infineon.com/igbt/



PG-TO-247-3

Applications:

- Inductive Cooking
- Soft Switching Applications

Type	V_{CE}	I_C	$V_{CE(sat),Tj=25°C}$	$T_{j,max}$	Marking	Package
IHW40N60T	600V	40A	1.55V	175°C	H40T60	PG-TO-247-3

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CE}	600	V
DC collector current, limited by T_{jmax}	I_C		A
T_C = 25°C		80	
T_C = 100°C		40	
Pulsed collector current, t_p limited by T_{jmax}	I_{Cpuls}	120	
Turn off safe operating area ($V_{CE} \leq$ 600V, $T_j \leq$ 175°C)	-	120	
Diode forward current, limited by T_{jmax}	I_F		
T_C = 25°C		40	
T_C = 100°C		20	
Diode pulsed current, t_p limited by T_{jmax}	I_{Fpuls}	60	
Gate-emitter voltage	V_{GE}	±20	V
Transient Gate-emitter voltage (t_p < 5 ms)		±25	
Short circuit withstand time[2)]	t_{SC}	5	µs
V_{GE} = 15V, $V_{CC} \leq$ 400V, $T_j \leq$ 150°C			
Power dissipation T_C = 25°C	P_{tot}	303	W
Operating junction temperature	T_j	-40...+175	°C
Storage temperature	T_{stg}	-55...+175	
Soldering temperature, 1.6mm (0.063 in.) from case for 10s	-	260	

[1] J-STD-020 and JESD-022

[2)] Allowed number of short circuits: <1000; time between short circuits: >1s.

Thermal Resistance

Parameter	Symbol	Conditions	Max. Value	Unit
Characteristic				
IGBT thermal resistance, junction – case	R_{thJC}		0.49	K/W
Diode thermal resistance, junction – case	R_{thJCD}		0.76	
Thermal resistance, junction – ambient	R_{thJA}		40	

Electrical Characteristic, at T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions	Value			Unit
			min.	Typ.	max.	
Static Characteristic						
Collector-emitter breakdown voltage	$V_{(BR)CES}$	V_{GE}=0V, I_C=0.5mA	600	-	-	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	V_{GE} = 15V, I_C=40A T_j=25°C T_j=175°C	 - -	 1.55 1.9	 2.05 -	
Diode forward voltage	V_F	V_{GE}=0V, I_F=20A T_j=25°C T_j=175°C	 - -	 1.1 1.05	 - -	
Gate-emitter threshold voltage	$V_{GE(th)}$	I_C=0.8mA, V_{CE}=V_{GE}	4.1	4.9	5.7	
Zero gate voltage collector current	I_{CES}	V_{CE}=600V, V_{GE}=0V T_j=25°C T_j=175°C	 - -	 - -	 40 1000	µA
Gate-emitter leakage current	I_{GES}	V_{CE}=0V, V_{GE}=20V	-	-	100	nA
Transconductance	g_{fs}	V_{CE}=20V, I_C=40A	-	22	-	S
Integrated gate resistor	R_{Gint}			-		Ω

Dynamic Characteristic

Parameter	Symbol	Conditions	min.	Typ.	max.	Unit
Input capacitance	C_{iss}	V_{CE}=25V, V_{GE}=0V, f=1MHz	-	2423	-	pF
Output capacitance	C_{oss}		-	113	-	
Reverse transfer capacitance	C_{rss}		-	72	-	
Gate charge	Q_{Gate}	V_{CC}=480V, I_C=40A V_{GE}=15V	-	215	-	nC
Internal emitter inductance measured 5mm (0.197 in.) from case	L_E		-	13	-	nH

Switching Characteristic, Inductive Load, at T_j=25 °C

Parameter	Symbol	Conditions	Value			Unit
			min.	Typ.	max.	
IGBT Characteristic						
Turn-on delay time	$t_{d(on)}$	T_j=25°C, V_{CC}=400V, I_C=40A, V_{GE}=0/15V, R_G=5.6 Ω, L_σ[1)]=40nH, C_σ[1)]=30pF Energy losses include "tail" and diode reverse recovery.	-	-	-	ns
Rise time	t_r		-	-	-	
Turn-off delay time	$t_{d(off)}$		-	186	-	
Fall time	t_f		-	66.3	-	
Turn-on energy	E_{on}		-	-	-	mJ
Turn-off energy	E_{off}		-	0.92	-	
Total switching energy	E_{ts}		-	0.92	-	

Switching Characteristic, Inductive Load, at T_j=175 °C

Parameter	Symbol	Conditions	Value			Unit
			min.	Typ.	max.	
IGBT Characteristic						
Turn-on delay time	$t_{d(on)}$	T_j=175°C, V_{CC}=400V, I_C=40A, V_{GE}=0/15V, R_G= 5.6 Ω L_σ[1)]=40nH, C_σ[1)]=30pF Energy losses include "tail" and diode reverse recovery.	-	-	-	ns
Rise time	t_r		-	-	-	
Turn-off delay time	$t_{d(off)}$		-	196	-	
Fall time	t_f		-	76.5	-	
Turn-on energy	E_{on}		-	-	-	mJ
Turn-off energy	E_{off}		-	1.4	-	
Total switching energy	E_{ts}		-	1.4	-	

[1)] Leakage inductance L_σ and Stray capacity C_σ due to dynamic test circuit in Figure E.

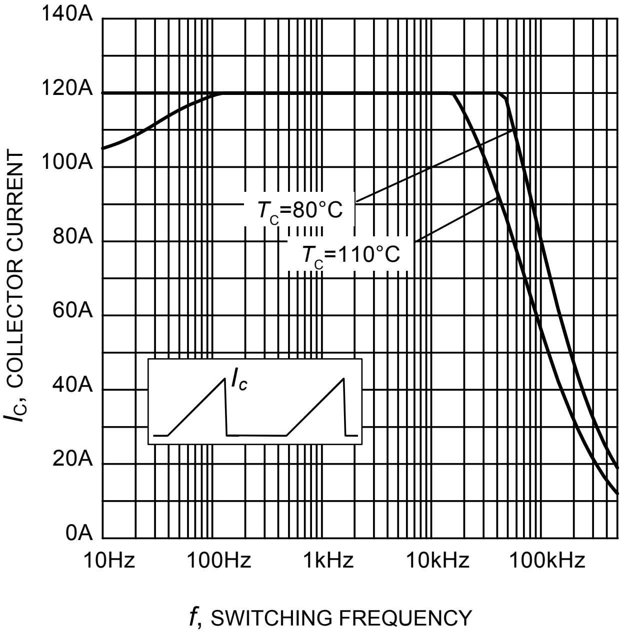


Figure 1. Collector current as a function of switching frequency for triangular current (E_{on} = 0, hard turn-off)
($T_j \leq$ 175°C, D = 0.5, V_{CE} = 400V, V_{GE} = 0/+15V, R_G = 5.6Ω)

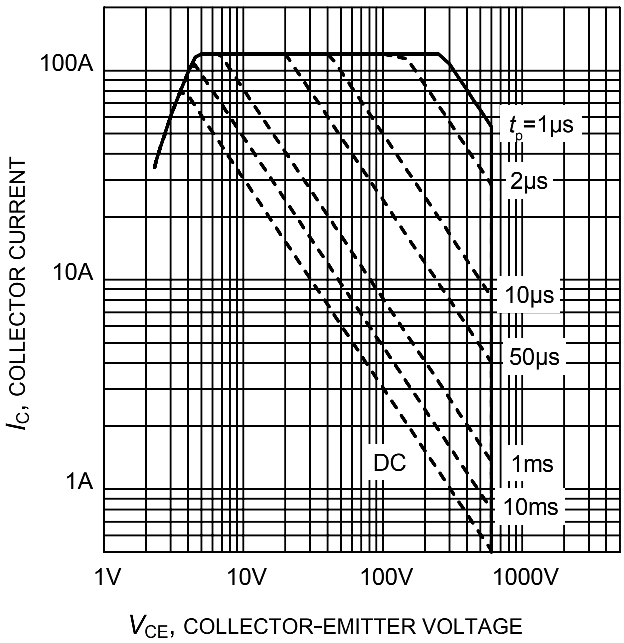


Figure 2. Safe operating area
(D = 0, T_C = 25°C, $T_j \leq$175°C; V_{GE}=15V)

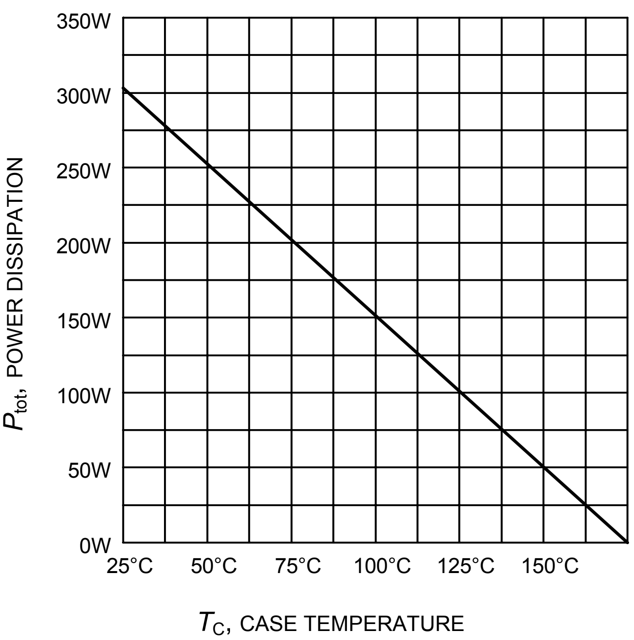


Figure 3. Power dissipation as a function of case temperature
($T_j \leq$ 175°C)

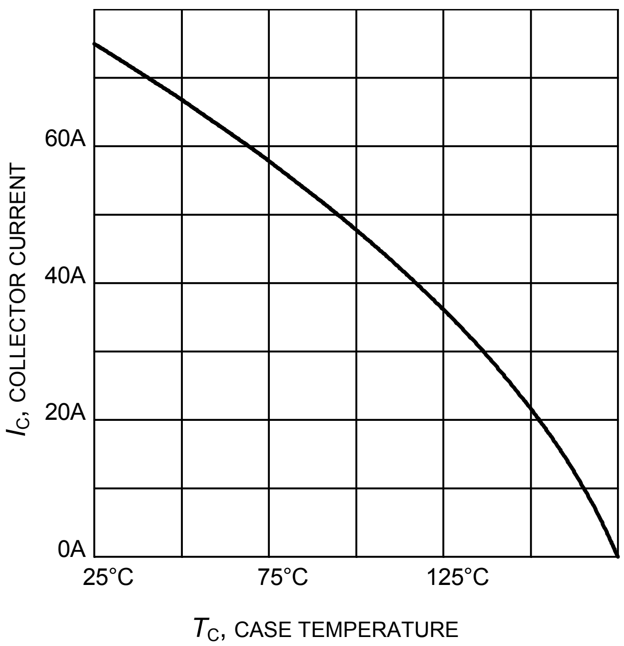


Figure 4. Collector current as a function of case temperature
($V_{GE} \geq$ 15V, $T_j \leq$ 175°C)

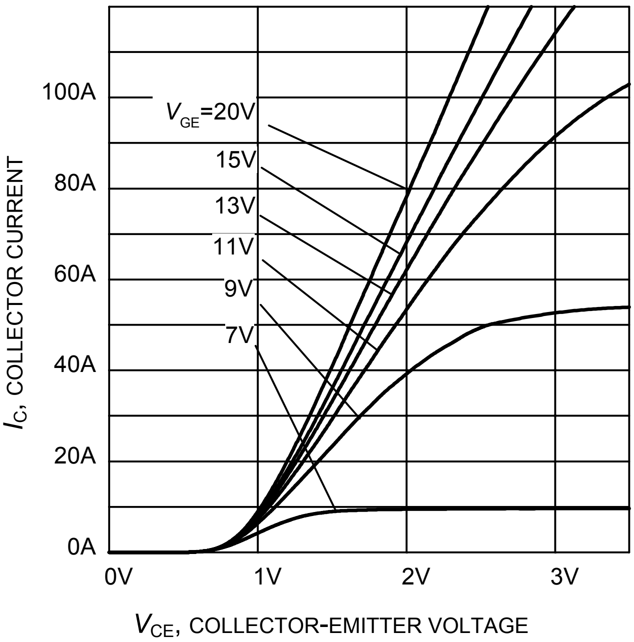


Figure 5. Typical output characteristic
(T_j = 25°C)

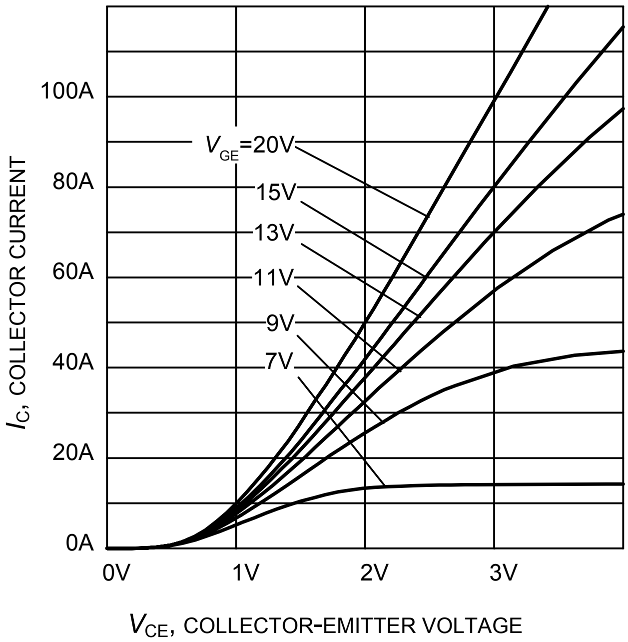


Figure 6. Typical output characteristic
(T_j = 175°C)

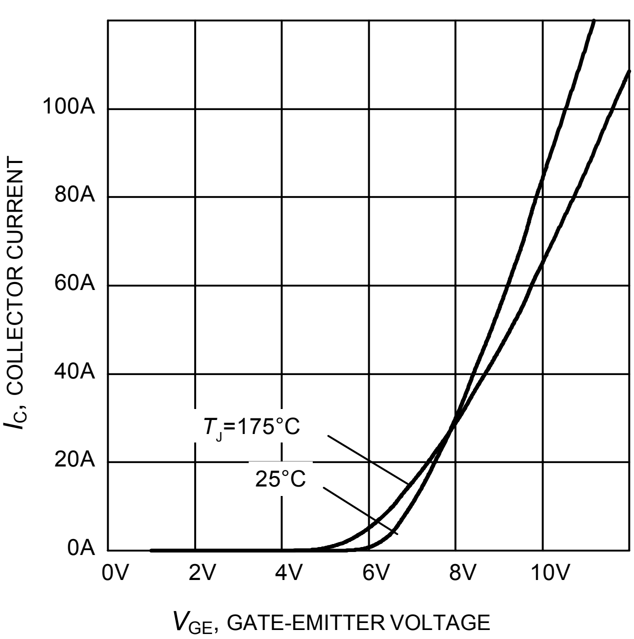


Figure 7. Typical transfer characteristic
(V_{CE}=20V)

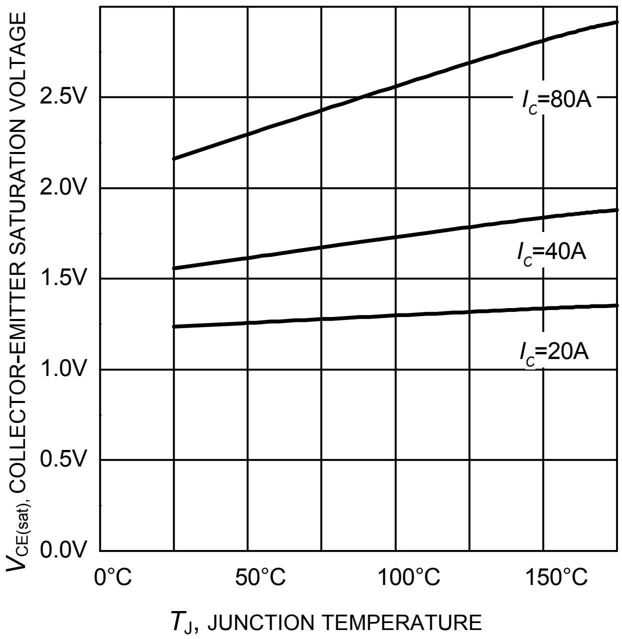


Figure 8. Typical collector-emitter saturation voltage as a function of junction temperature
(V_{GE} = 15V)

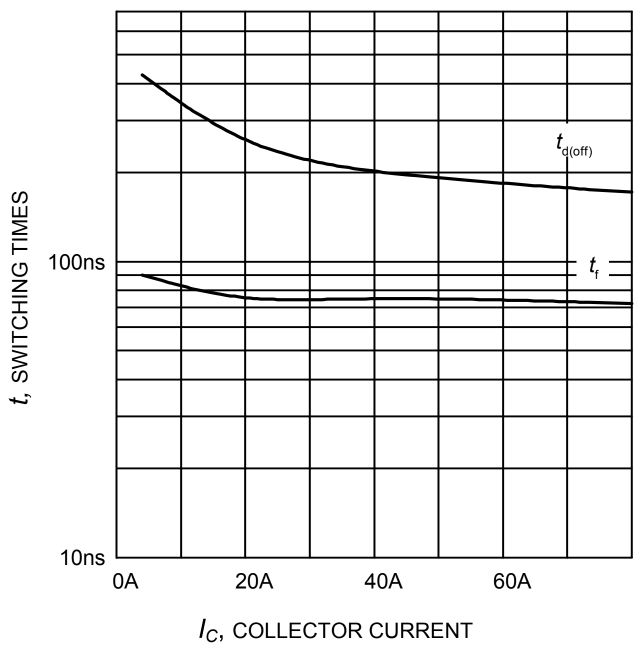


Figure 9. Typical switching times as a function of collector current
(inductive load, T_J=175°C,
V_{CE} = 400V, V_{GE} = 0/15V, R_G = 5.6Ω,
Dynamic test circuit in Figure E)

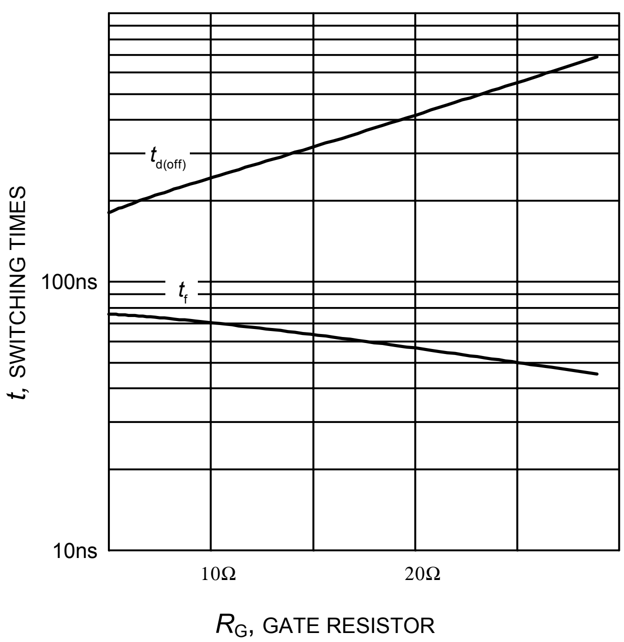


Figure 10. Typical switching times as a function of gate resistor
(inductive load, T_J = 175°C,
V_{CE}= 400V, V_{GE} = 0/15V, I_C = 40A,
Dynamic test circuit in Figure E)

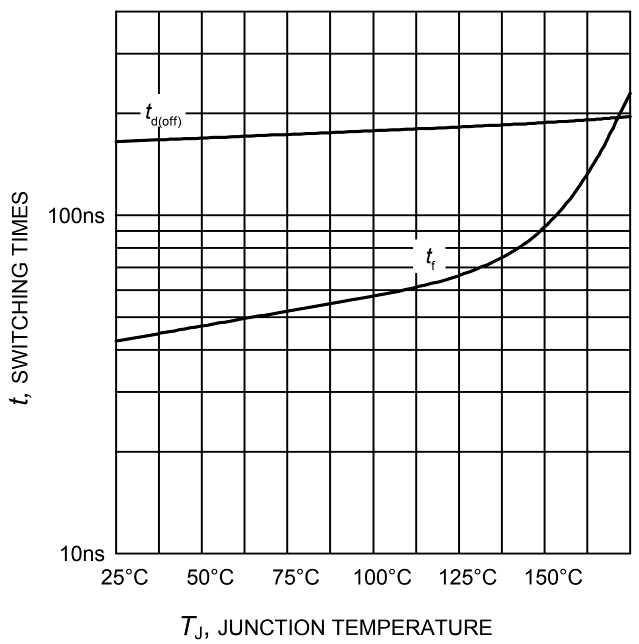


Figure 11. Typical switching times as a function of junction temperature
(inductive load, V_{CE} = 400V,
V_{GE} = 0/15V, I_C = 40A, R_G=5.6Ω,
Dynamic test circuit in Figure E)

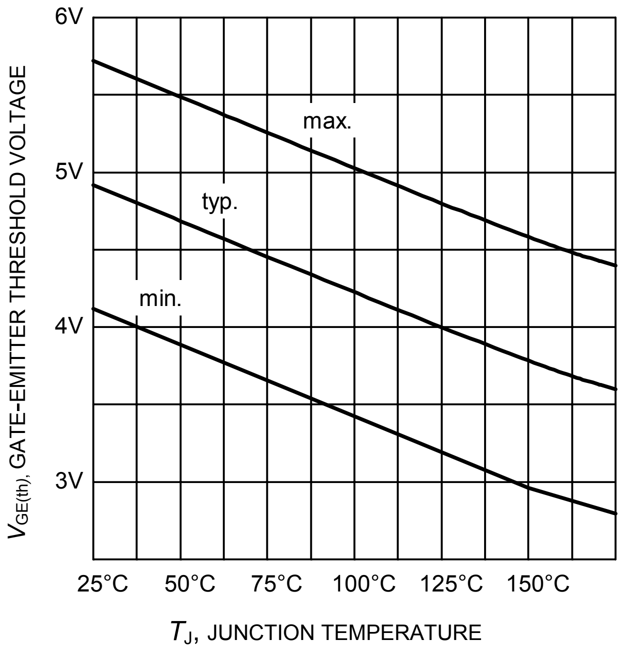


Figure 12. Gate-emitter threshold voltage as a function of junction temperature
(I_C = 0.8mA)

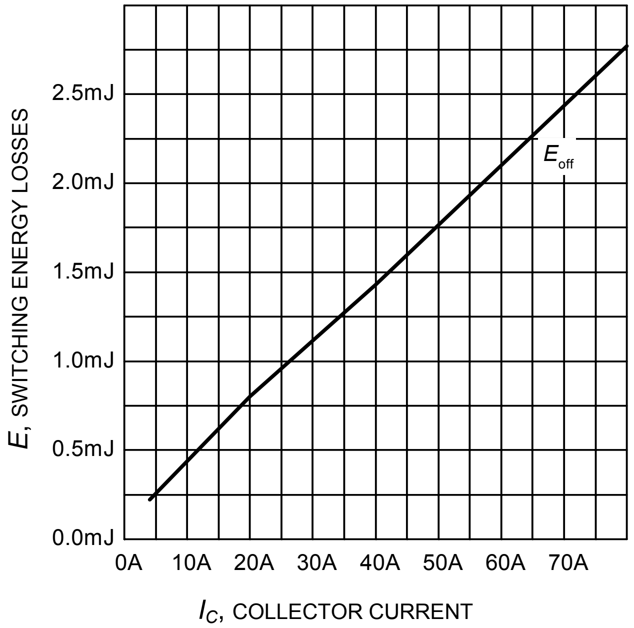


Figure 13. Typical switching energy losses as a function of collector current
(inductive load, T_J = 175°C, V_{CE} = 400V, V_{GE} = 0/15V, R_G = 5.6Ω, Dynamic test circuit in Figure E)

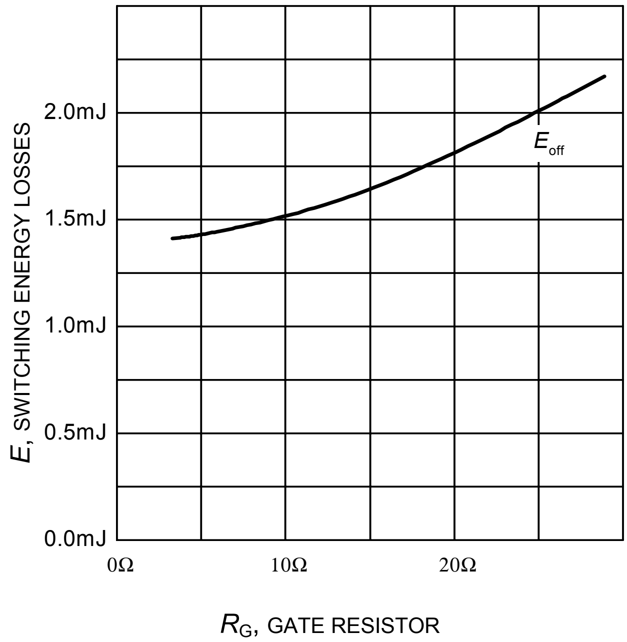


Figure 14. Typical switching energy losses as a function of gate resistor
(inductive load, T_J = 175°C, V_{CE} = 400V, V_{GE} = 0/15V, I_C = 40A, Dynamic test circuit in Figure E)

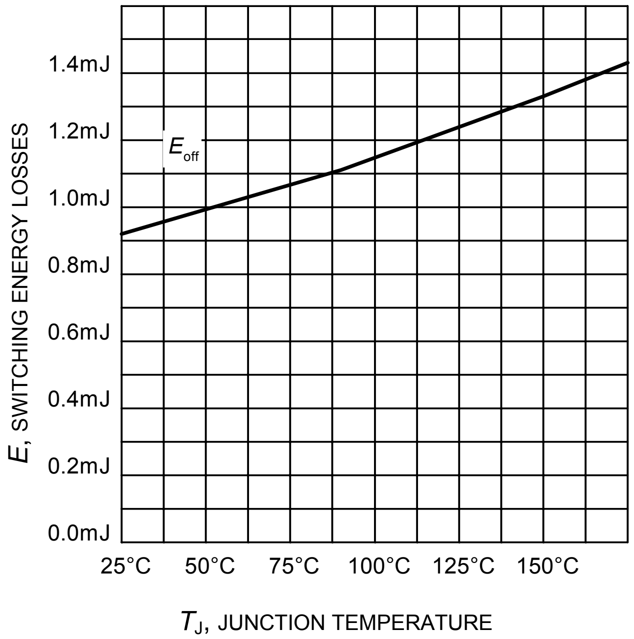


Figure 15. Typical switching energy losses as a function of junction temperature
(inductive load, V_{CE} = 400V, V_{GE} = 0/15V, I_C = 40A, R_G = 5.6Ω, Dynamic test circuit in Figure E)

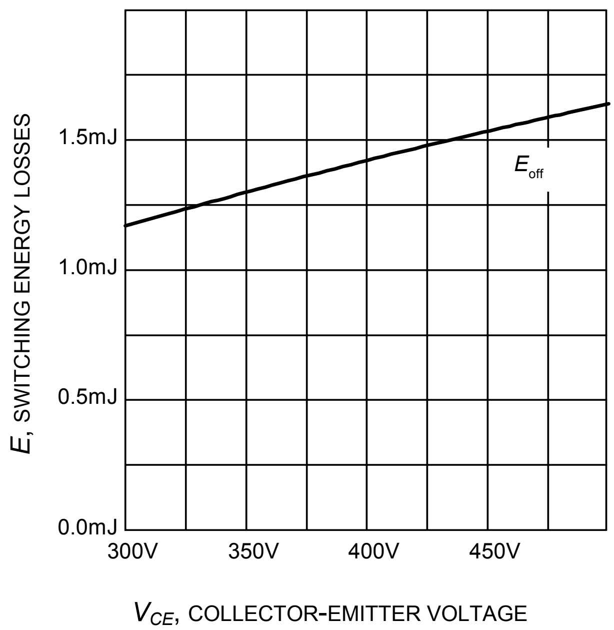


Figure 16. Typical switching energy losses as a function of collector emitter voltage
(inductive load, T_J = 175°C, V_{GE} = 0/15V, I_C = 40A, R_G = 5.6Ω, Dynamic test circuit in Figure E)

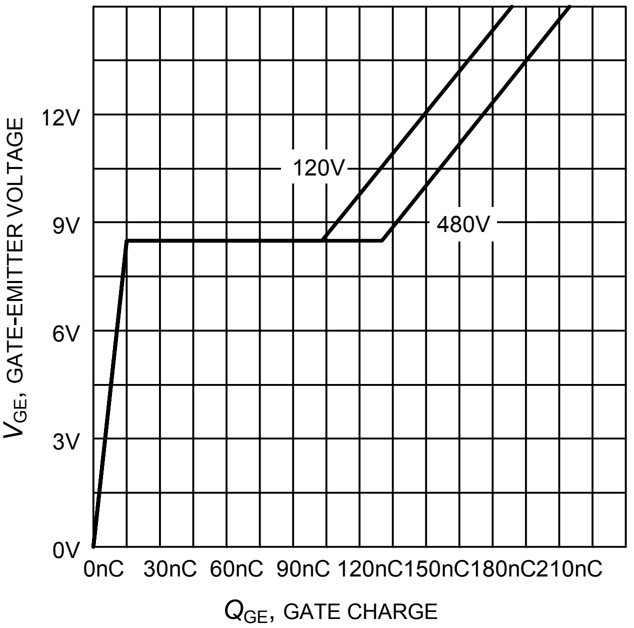


Figure 17. Typical gate charge
(I_C=40 A)

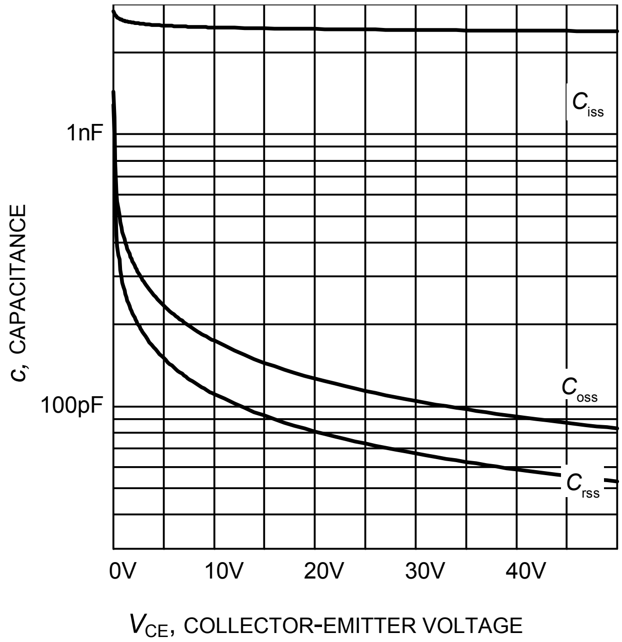


Figure 18. Typical capacitance as a function of collector-emitter voltage
(V_{GE}=0V, f = 1 MHz)

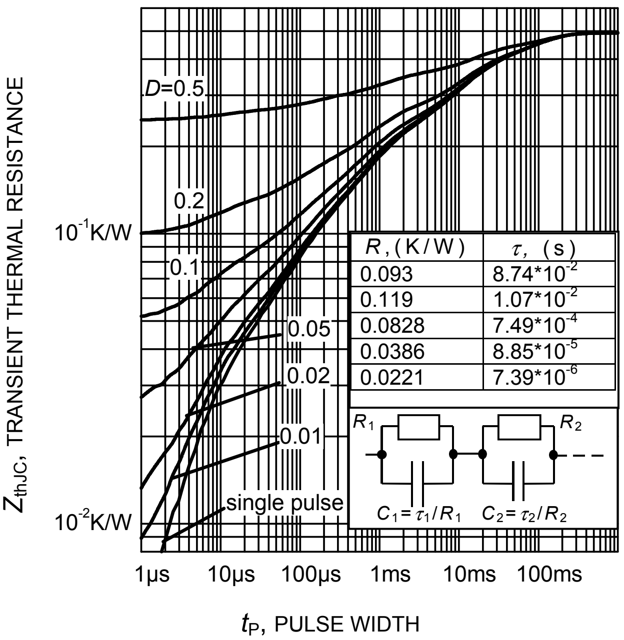


Figure 19. IGBT transient thermal resistance
(D = t_p / T)

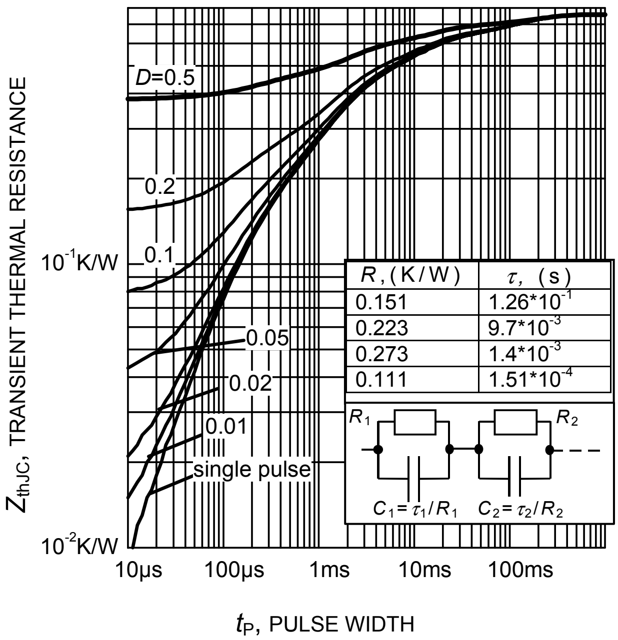


Figure 20. Diode transient thermal impedance as a function of pulse width
(D=t_P/T)

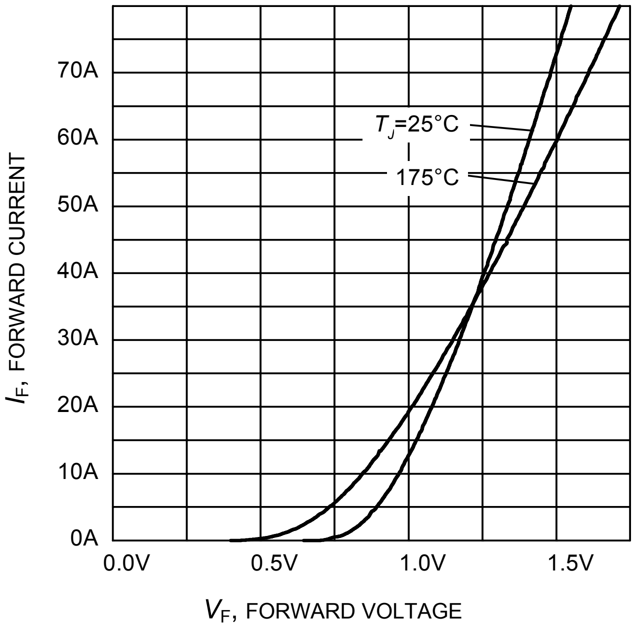


Figure 21. Typical diode forward current as a function of forward voltage

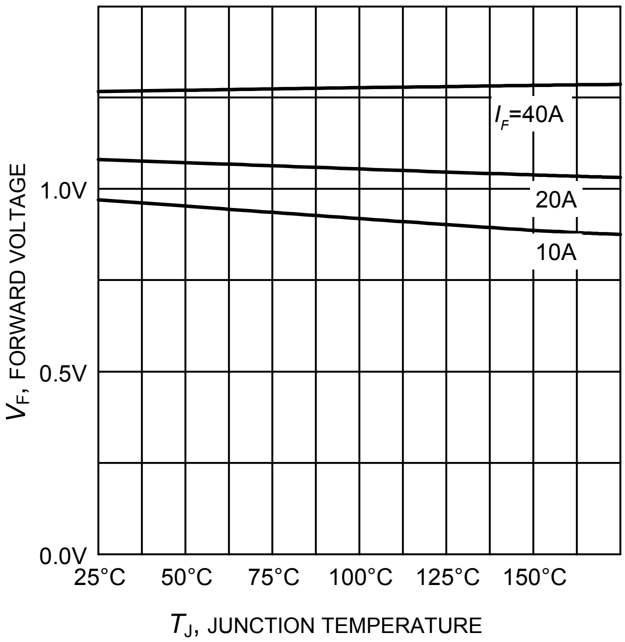


Figure 22. Typical diode forward voltage as a function of junction temperature

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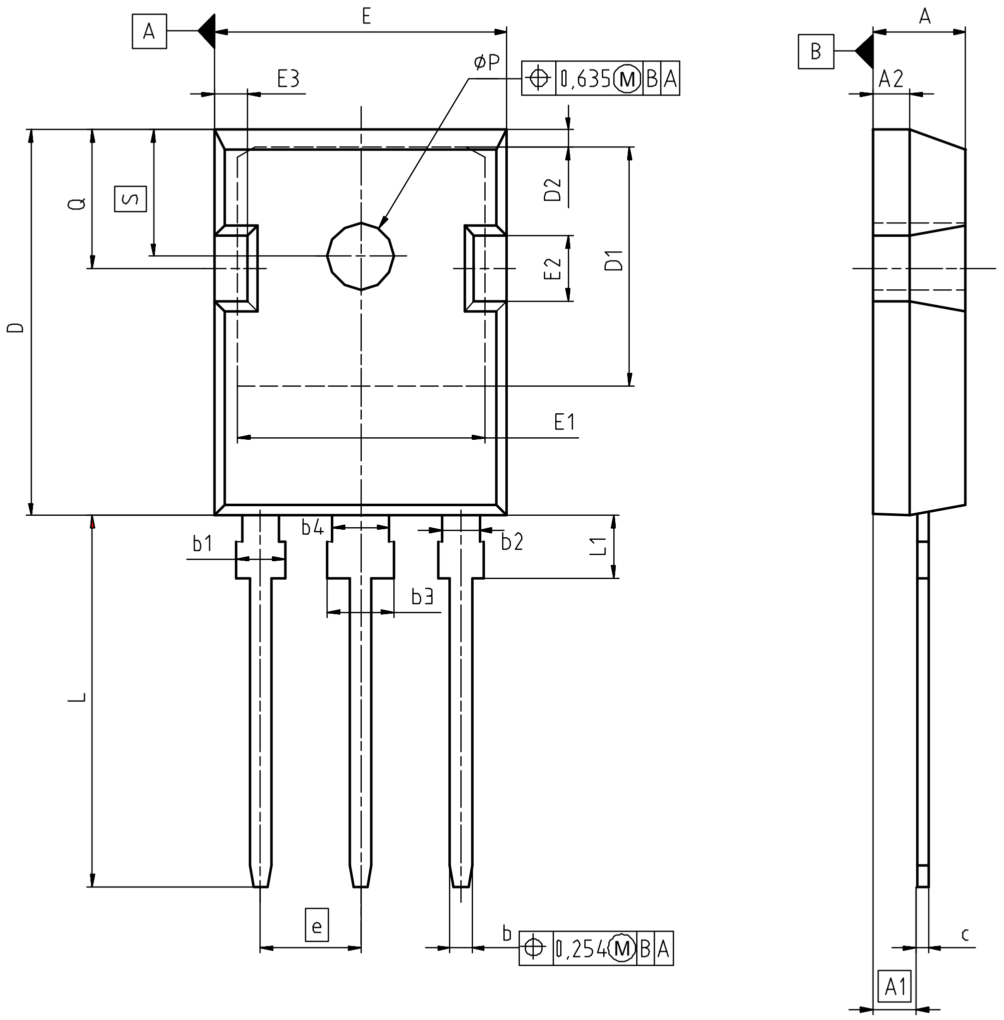
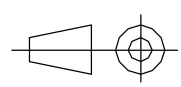


DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.90	5.16	0.193	0.203
A1	2.27	2.53	0.089	0.099
A2	1.85	2.11	0.073	0.083
b	1.07	1.33	0.042	0.052
b1	1.90	2.41	0.075	0.095
b2	1.90	2.16	0.075	0.085
b3	2.87	3.38	0.113	0.133
b4	2.87	3.13	0.113	0.123
c	0.55	0.68	0.022	0.027
D	20.82	21.10	0.820	0.831
D1	16.25	17.65	0.640	0.695
D2	1.05	1.35	0.041	0.053
E	15.70	16.03	0.618	0.631
E1	13.10	14.15	0.516	0.557
E2	3.68	5.10	0.145	0.201
E3	1.68	2.60	0.066	0.102
e	5.44		0.214	
N	3		3	
L	19.80	20.31	0.780	0.799
L1	4.17	4.47	0.164	0.176
øP	3.50	3.70	0.138	0.146
Q	5.49	6.00	0.216	0.236
S	6.04	6.30	0.238	0.248

DOCUMENT NO.
Z8B00003327

SCALE 0 5 0 5 7.5mm

EUROPEAN PROJECTION



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03

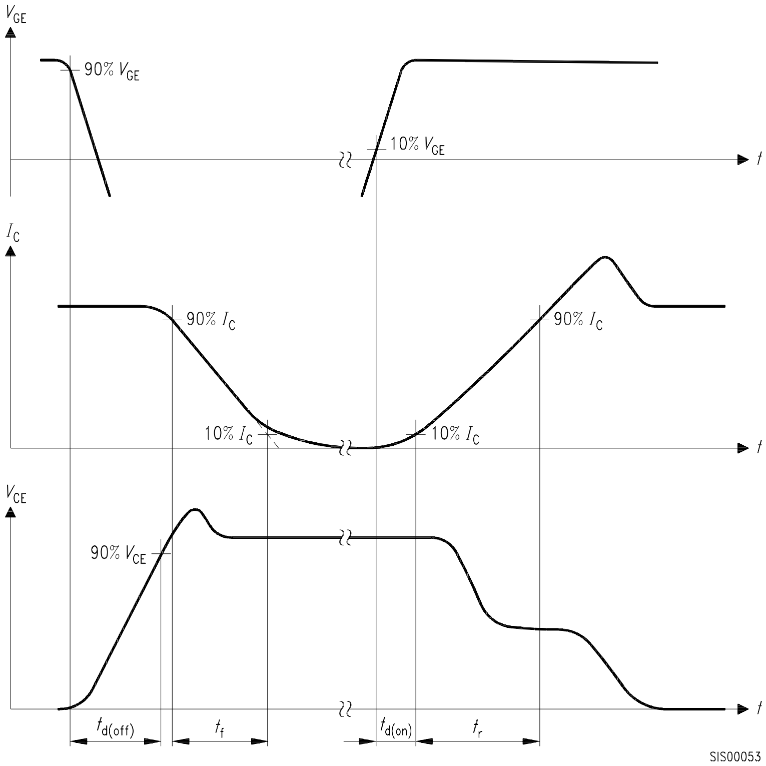

Figure A. Definition of switching times

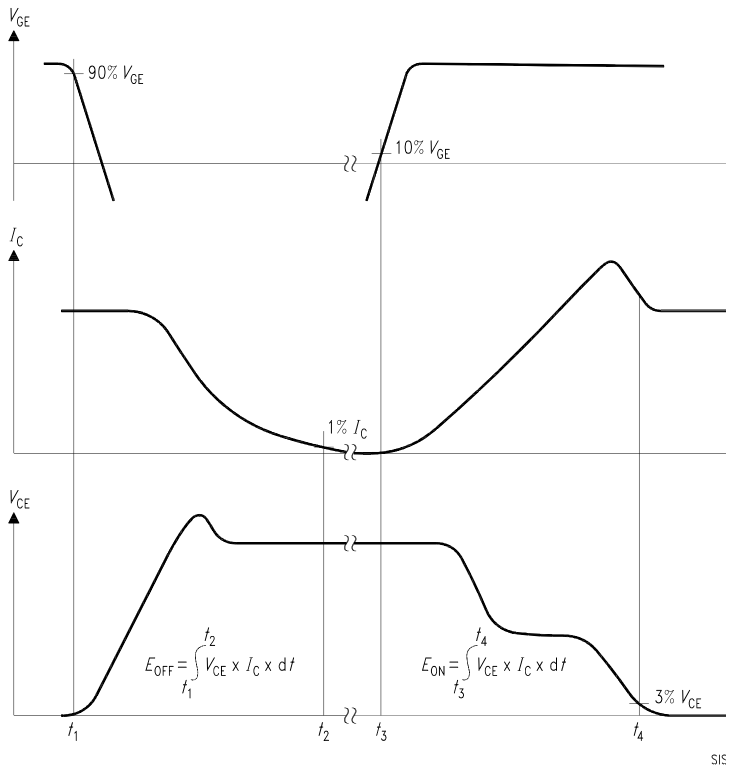

Figure B. Definition of switching losses

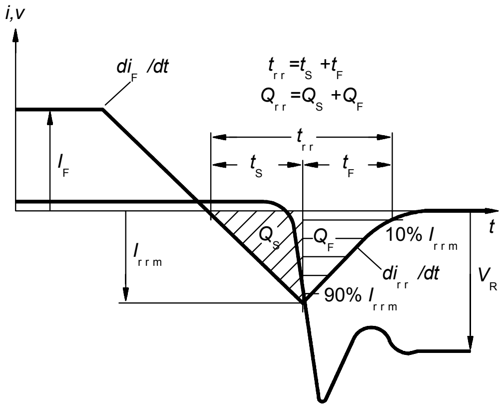

Figure C. Definition of diodes switching characteristics

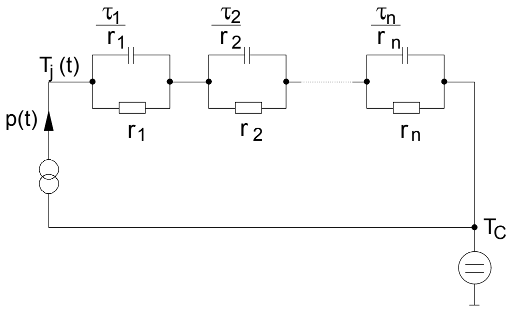

Figure D. Thermal equivalent circuit

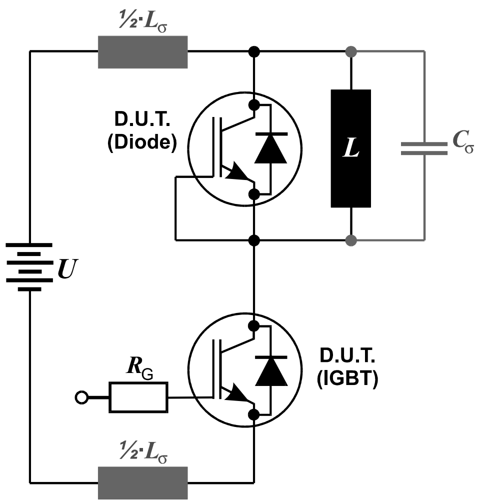

Figure E. Dynamic test circuit

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