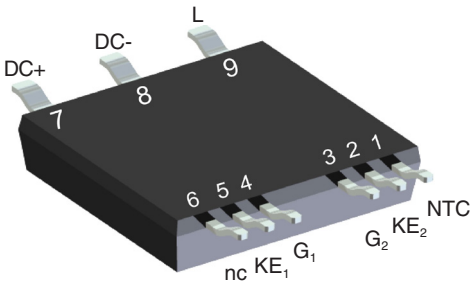
Trench IGBT phaseleg

ISOPLUS™
Surface Mount Power Device
including a NTC

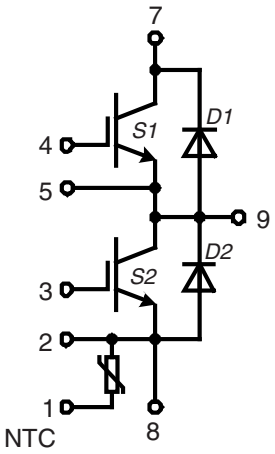
V_{CES} = 1200 V
I_{C25} = 60 A
$V_{CE(sat)}$ = 2.05 V

Part number
ITF40PF1200DHGTLB



Backside: isolated

E72873



Features / Advantages:

- Easy paralleling due to the positive temperature coefficient of the on-state voltage
- Fast Trench IGBT
  - very low $V_{CE(sat)}$
  - short circuit rated for 10 µsec.
  - very low gate charge
  - low EMI
  - square RBSOA @ 3x I_C
- Sonic™ diode
  - fast and soft reverse recovery
  - low operating forward voltage

Applications:

- **Phaseleg**
  - buck-boost chopper
  - inductive heating
- **Full bridge**
  - power supplies
  - induction heating
  - four quadrant DC drives
  - controlled rectifier
- **Three phase bridge**
  - AC drives
  - controlled rectifier

Package: SMPD-B

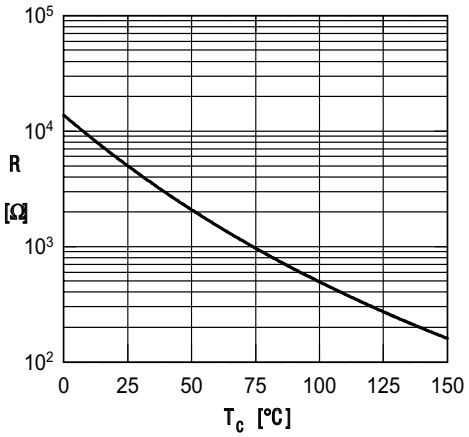
- isolation voltage 3000 V
- isolated surface to heatsink
- low coupling capacity between pins and heatsink
- PCB space saving
- enlarged creepage towards heatsink
- application friendly pinout
- low inductive current path
- high reliability

IGBTs S1/S2				Ratings			
Symbol	**Definitions**	**Conditions**		**min.**	**typ.**	**max.**	
V_{CES}	*collector emitter voltage*		T_{VJ} = 25°C			1200	V
V_{GES}	*max. DC gate voltage*		T_{VJ} = 25°C	-15		+15	V
V_{GEM}	*max. transient gate emitter voltage*			-20		+20	V
I_{C25}	*collector current*		T_C = 25°C			60	A
I_{C80}			T_C = 80°C			46	A
I_{c100}			T_C = 100°C			38	A
P_{tot}	*total power dissipation*		T_C = 25°C			270	W
$V_{CE(sat)}$	*collector emitter saturation voltage*	I_C = 40 A; V_{GE} = 15 V	T_{VJ} = 25°C		2.05	2.40	V
			T_{VJ} = 150°C		2.50		V
$V_{GE(th)}$	*gate emitter threshold voltage*	I_C = 1 mA; V_{GE} = V_{CE}	T_{VJ} = 25°C	5	5.8	6.5	V
I_{CES}	*collector emitter leakage current*	V_{CE} = $V_{CES(OP)}$; V_{GE} = 0 V	T_{VJ} = 25°C			0.06	mA
			T_{VJ} = 150°C		0.5		mA
I_{GES}	*gate emitter leakage current*	V_{GE} = ±20 V				600	nA
C_{iss}	*input capacitance*	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 Mhz			2330		pF
C_{oss}	*output capacitance*				150		pF
C_{rss}	*reverse transfer capacitance*				130		pF
Q_{Gon}	*total gate charge*	V_{CE} = 600 V; V_{GE} = 0 /15 V; I_C = 40 A			175		nC
$t_{d(on)}$	*turn-on delay time*	inductive load			24		ns
t_r	*current rise time*				24		ns
$t_{d(off)}$	*turn-off delay time*				290		ns
t_f	*current fall time*	V_{CE} = 600 V; I_C = 40 A	T_{VJ} = 25°C		52		ns
E_{on}	*turn-on energy per pulse*	V_{GE} = 0/15 V; R_G = 12 Ω			2.3		mJ
E_{off}	*turn-off energy per pulse*				1.4		mJ
$E_{rec(off)}$	*reverse recovery losses at turn- off*				0.4		mJ
$t_{d(on)}$	*turn-on delay time*	inductive load			26		ns
t_r	*current rise time*				26		ns
$t_{d(off)}$	*turn-off delay time*				350		ns
t_f	*current fall time*	V_{CE} = 600 V; I_C = 40 A	T_{VJ} = 150°C		110		ns
E_{on}	*turn-on energy per pulse*	V_{GE} = 0/15 V; R_G = 12 Ω			3.0		mJ
E_{off}	*turn-off energy per pulse*				2.2		mJ
$E_{rec(off)}$	*reverse recovery losses at turn- off*				1.2		mJ
RBSOA	*reverse bias safe operating area*	V_{GE} = 15 V;	T_{VJ} ≤ 175°C				
I_{CM}		V_{CEmax} = 1000 V				140	A
SCSOA	*short circuit safe operation area*	V_{CE} = 600 V; V_{GE} = ±15 V	T_{VJ} ≤ 175°C				
t_{SC}	*short circuit duration*	R_G = 12 Ω; none repetitive				10	µs
I_{SC}	*short circuit current*				140		A
R_{thJC}	*thermal resistance junction to case*					0.55	K/W
R_{thJH}	*thermal resistance junction to heatsink*	with heat transfer paste (IXYS test setup)			0.80		K/W

Diodes D1/D2				Ratings			
Symbol	**Definitions**	**Conditions**		**min.**	**typ.**	**max.**	
V_{RRM}	*max. repetitive reverse voltage*		T_C = 25°C			1200	V
I_{F25}	*forward current*		T_C = 25°C			52	A
I_{F80}			T_C = 80°C			38	A
I_{F100}			T_C = 100°C			30	A
V_F	*forward voltage*	I_F = 40 A	T_{VJ} = 25°C			2.50	V
			T_{VJ} = 150°C		2.55		V
Q_{rr}	*reverse recovery charge*	V_R = 600 V; I_F = 40 A V_{GE} = 0 / 15 V; R_G = 12 Ω $-di_F/dt$ = -1700 A/µs	T_{VJ} = 25°C		1.8		µC
I_{RM}	*max. reverse recovery current*				45		A
t_{rr}	*forward recovery time*				105		ns
E_{rec}	*reverse recovery losses*				0.4		mJ
Q_{rr}	*reverse recovery charge*	V_R = 600 V; I_F = 40 A V_{GE} = 0 / 15 V; R_G = 12 Ω $-di_F/dt$ = -1800 A/µs	T_{VJ} = 150°C		3.7		µC
I_{RM}	*max. reverse recovery current*				55		A
t_{rr}	*forward recovery time*				235		ns
E_{rec}	*reverse recovery losses*				1.2		mJ
R_{thJC}	*thermal resistance junction to case*					1.00	K/W
R_{thJH}	*thermal resistance junction to heatsink*	with heat transfer paste (IXYS test setup)			1.35		K/W

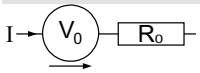
Package ISOPLUS-SMPD				Ratings			
Symbol	**Definitions**	**Conditions**		**min.**	**typ.**	**max.**	**Unit**
I_{RMS}	*RMS current*	per wide pins 7, 8, 9 per slim pins 1,2,3 and 4,5,6 Max current may be additionally limited by external connections (PCB tracks)				100 50	A A
C_P	*coupling capacity*	between shorted pins and back side metallization			90		pF
$R_{pin\text{-}chip}$	*resistance terminal to chip*	$V_{CE} = V_{CE(sat)} + 2 \cdot I_C \cdot R_{pin\text{-}chip}$)			0.5		mΩ
T_{VJM}	*max. virtual junction temperature*			-55		175	°C
T_{OP}	*operation temperature*			-55		150	°C
T_{stg}	*storage temperature*			-55		125	°C
Weight					8.5		g
F_C	*mounting force with clip*			40		130	N
$d_{Spp/App}$	*creepage distance on surface / strikiing distance through air*		*slim pin to slim pin*	1.6			mm
			wide pin to wide pin	6.8			mm
$d_{Spb/Apb}$			*pin to backside*	4.0			mm
V_{ISOL}	*isolation voltage*	t = 1 second	50/60 Hz, RMS, $I_{ISOL} \leq$ 1 mA	3000			V
		t = 1 minute		2500			V

Temperature Sensor NTC			Ratings			
Symbol	Definitions	Conditions	min.	typ.	max.	Unit
R_{25}	*resistance*	T_C = 25°C	4.75	5	5.25	kΩ
$B_{25/50}$	*temperature coefficient*			3375		K



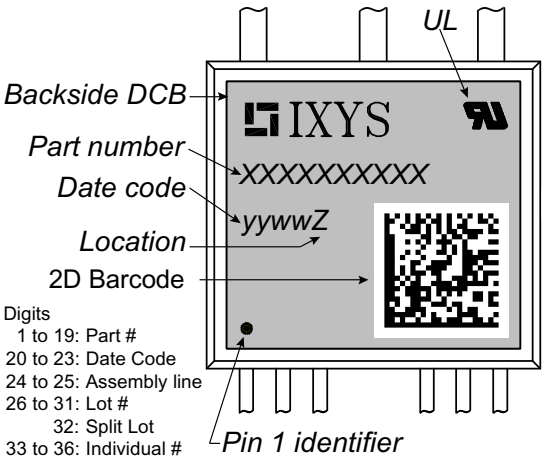
Typ. NTC resistance vs. temperature

Equivalent Circuits for Simulation **on die level* T_{VJ} = 175°C



		IGBT	Diode	
$V_{0\ max}$	*threshold voltage*	1.05	1.25	V
$R_{0\ max}$	*slope resistance **	50	28.3	mΩ

Package ISOPLUS-SMPD

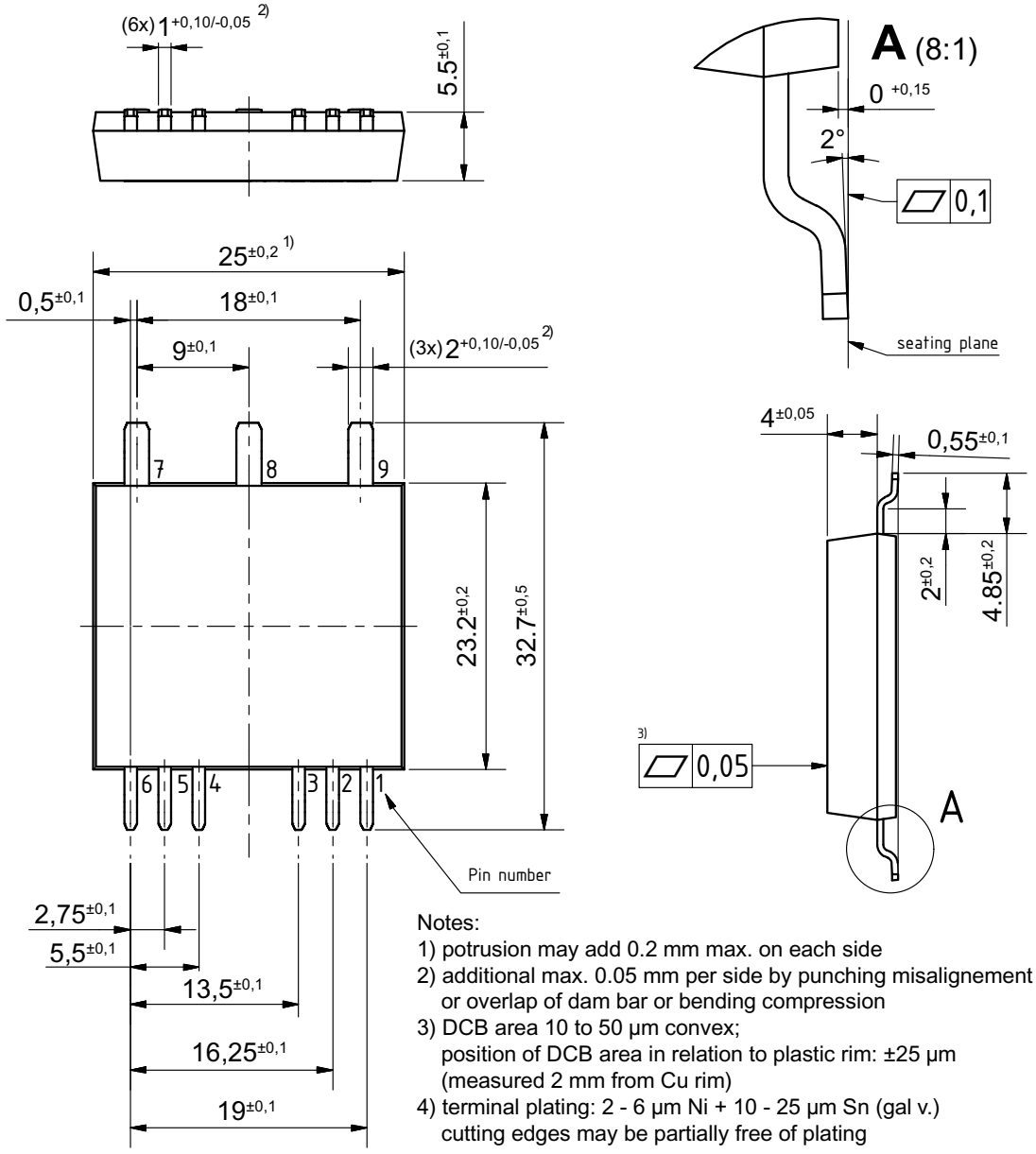


Part number

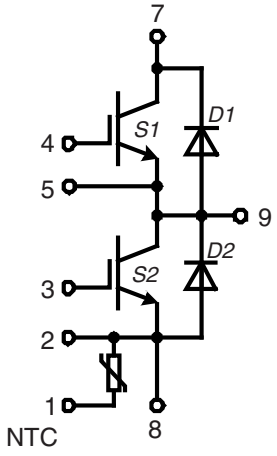
I = IGBT
T = IGBT Trench
F = Fast
40 = Current Rating [A]
PF = Phase leg + free wheeling diodes
1200 = Reverse Voltage [V]
D = Diode
H = Sonic Fast Recovery Diode
G = extreme fast
T = NTC
LB = SMPD-B

Ordering	Part Name	Marking on Product	Delivering Mode	Base Qty	Ordering Code
Standard	ITF40PF1200DHGTLB-TRR	ITF40PF1200DHGTLB	Tape&Reel	200	IX526119
	ITF40PF1200DHGTLB-TUB	ITF40PF1200DHGTLB	Tube	20	IX526112

Outlines SMPD-B



Notes:
1) potrusion may add 0.2 mm max. on each side
2) additional max. 0.05 mm per side by punching misalignement or overlap of dam bar or bending compression
3) DCB area 10 to 50 µm convex;
position of DCB area in relation to plastic rim: ±25 µm (measured 2 mm from Cu rim)
4) terminal plating: 2 - 6 µm Ni + 10 - 25 µm Sn (gal v.)
cutting edges may be partially free of plating



IGBTs S1/S2

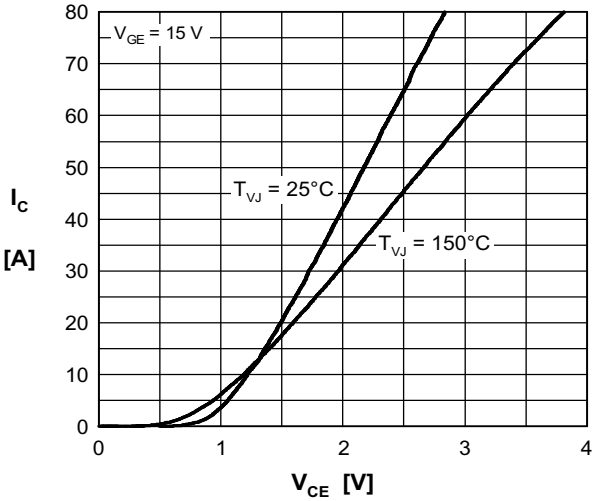


Fig. 1 Typ. output characteristics

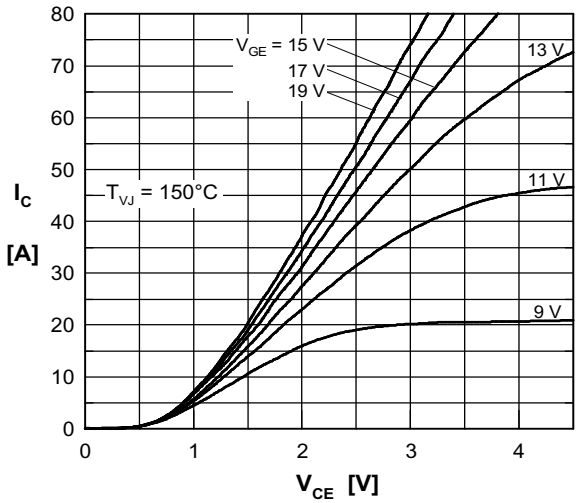


Fig. 2 Typ. output characteristics

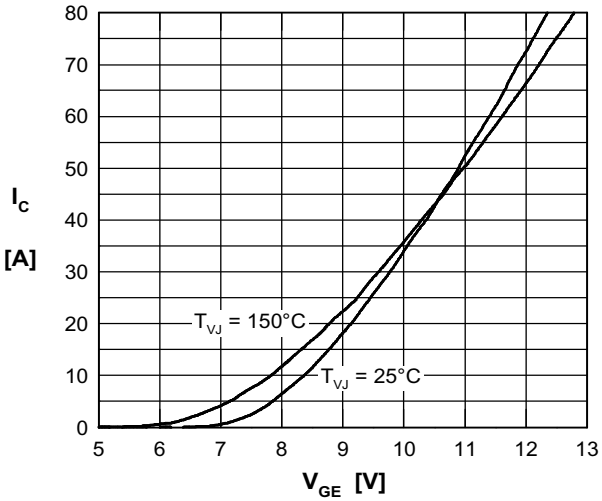


Fig. 3 Typ. transfer characteristics

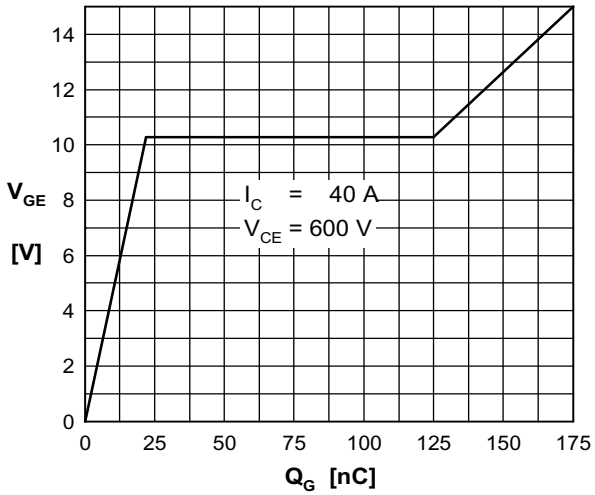


Fig. 4 Typ. turn-on gate charge

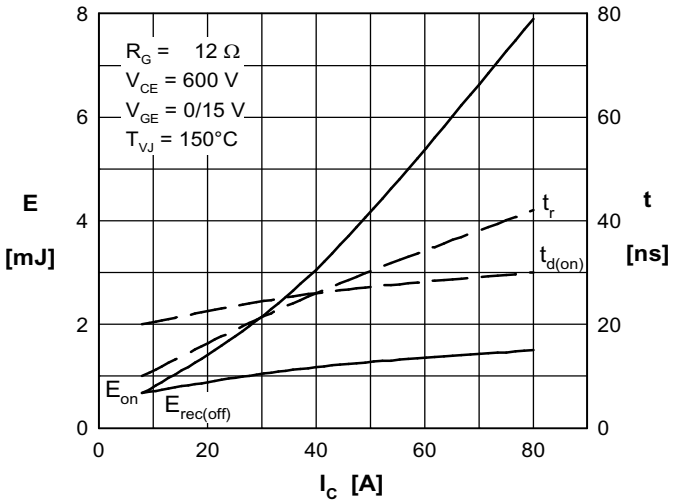


Fig. 5 Typ. turn-on energy & switching times versus collector current

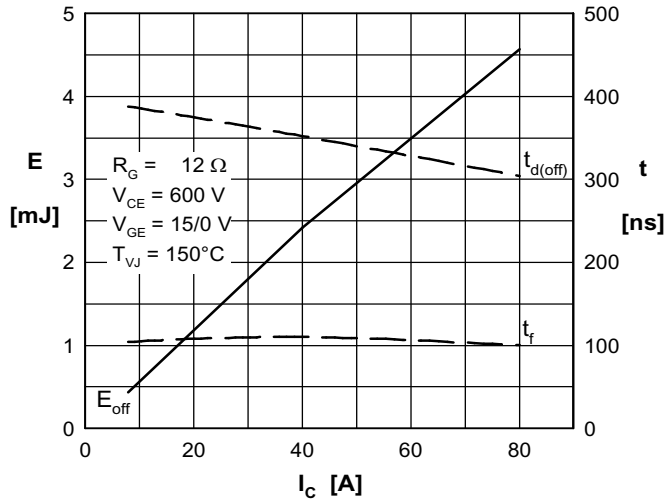


Fig. 6 Typ. turn-off energy & switching times versus collector current

IGBTs S1/S2

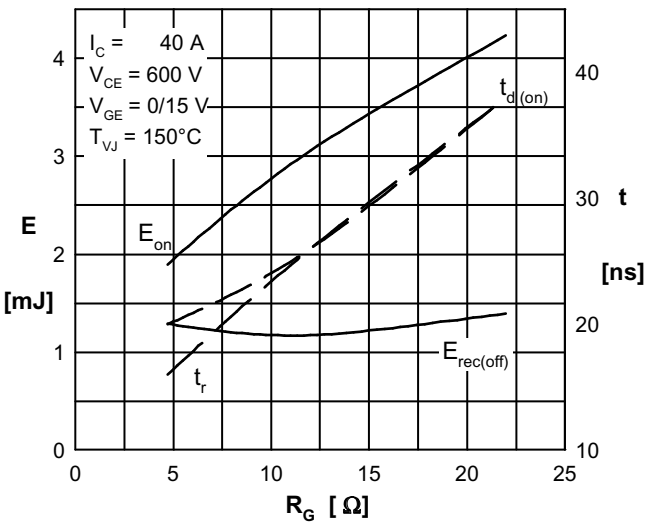


Fig. 7 Typ. turn-on energy and switching times versus gate resistor

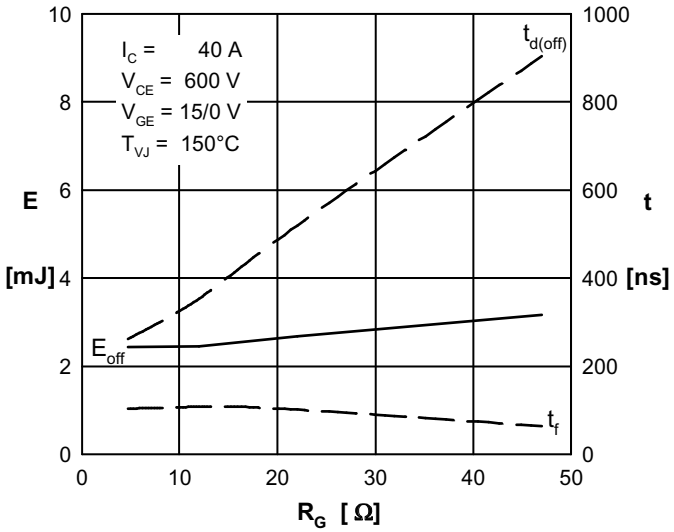


Fig. 8 Typ. turn-off energy and switching times versus gate resistor

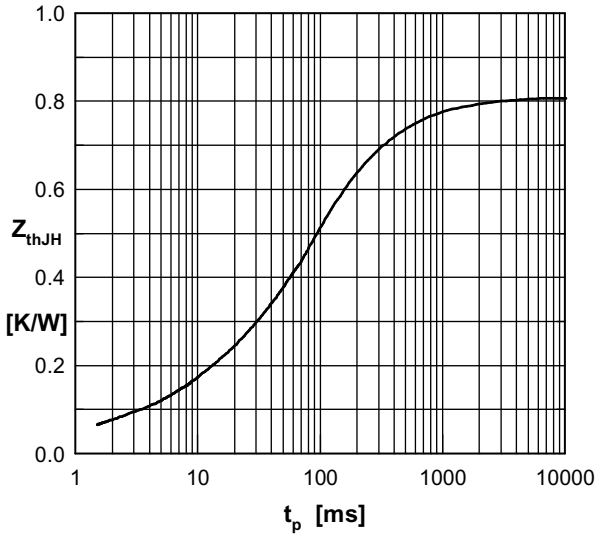


Fig. 9 Typ. transient thermal impedance junction to heatsink

Diodes D1/D2

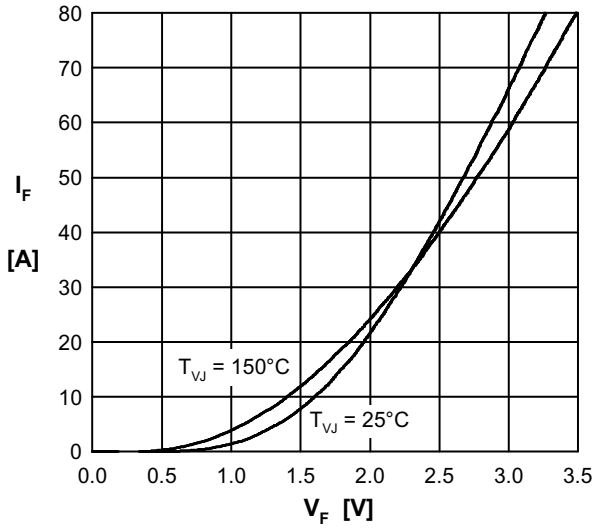


Fig. 10 Typ. forward characteristics

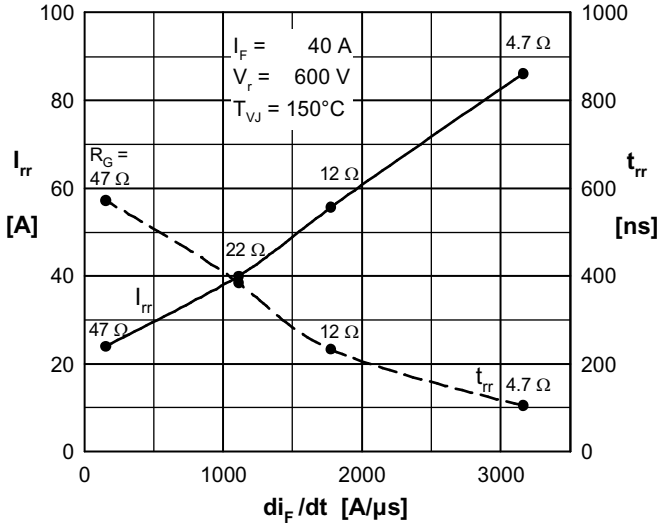


Fig. 11 Typ. reverse recovery characteristics

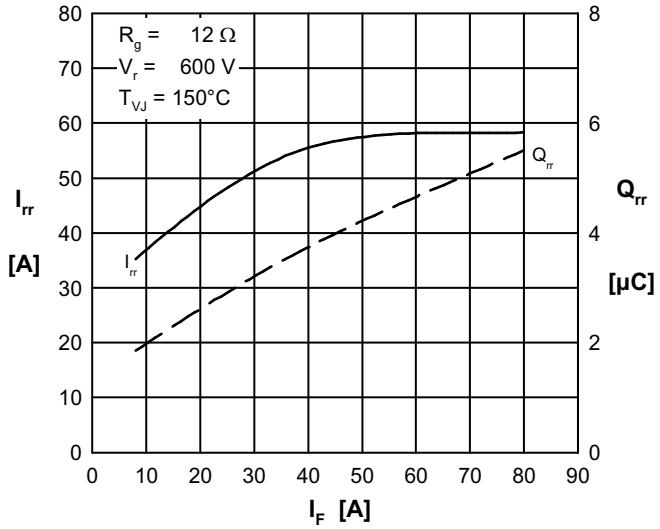


Fig. 12 Typ. reverse recovery characteristics

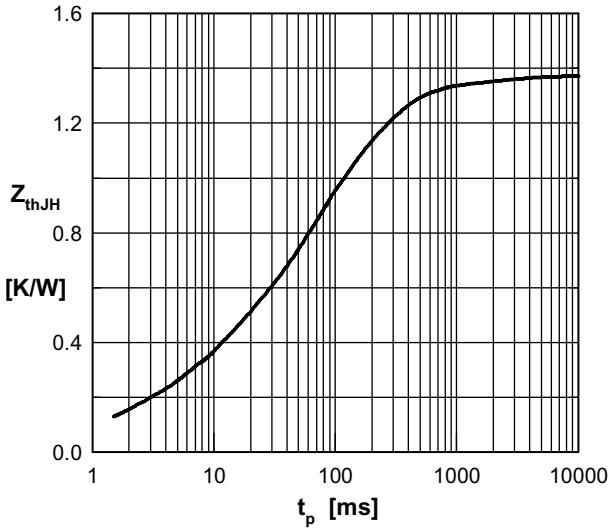


Fig. 13 Typ. transient thermal impedance junction to heatsink