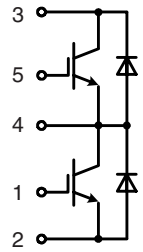
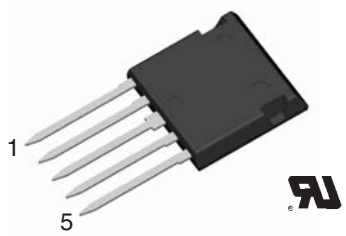
NPT³ IGBT

Phaseleg Topology in ISOPLUS i4-PAC™

I_{C25} = 33 A
V_{CES} = 1200 V
$V_{CE(sat)\,typ}$ = 2.4 V





IGBTs

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C to 150°C	1200	V
V_{GES}		± 20	V
I_{C25}	T_C = 25°C	33	A
I_{C90}	T_C = 90°C	20	A
I_{CM}	V_{GE} = ±15 V; R_G = 68 Ω; T_{VJ} = 125°C	40	A
V_{CEK}	RBSOA, Clamped inductive load; L = 100 µH	V_{CES}	
t_{SC} (SCSOA)	V_{CE} = 900V; V_{GE} = ±15 V; R_G = 68 Ω; T_{VJ} = 125°C non-repetitive	10	µs
P_{tot}	T_C = 25°C	150	W

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
$V_{CE(sat)}$	I_C = 20 A; V_{GE} = 15 V; T_{VJ} = 25°C		2.4	2.9	V
	T_{VJ} = 125°C		2.8		V
$V_{GE(th)}$	I_C = 0.6 mA; V_{GE} = V_{CE}	4.5		6.5	V
I_{CES}	V_{CE} = V_{CES}; V_{GE} = 0 V; T_{VJ} = 25°C			0.2	mA
	T_{VJ} = 125°C		0.2		mA
I_{GES}	V_{CE} = 0 V; V_{GE} = ± 20 V			200	nA
$t_{d(on)}$	Inductive load, T_{VJ} = 125°C		205		ns
t_r	V_{CE} = 600 V; I_C = 20 A		105		ns
$t_{d(off)}$	V_{GE} = ±15 V; R_G = 68 Ω		320		ns
t_f			175		ns
E_{on}			4.1		mJ
E_{off}			1.5		mJ
C_{ies}	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MHz		1.2		nF
Q_{Gon}	V_{CE} = 600 V; V_{GE} = 15 V; I_C = 20 A		100		nC
R_{thJC}				0.8	K/W
R_{thJH}	with heat transfer paste		1.2		K/W

PHASE-OUT

Features

- NPT³ IGBT
  - positive temperature coefficient of saturation voltage for easy paralleling
  - fast switching
  - short tail current for optimized performance in resonant circuits
- HiPerFRED™ diode
  - fast reverse recovery
  - low operating forward voltage
  - low leakage current
- ISOPLUS i4-PAC™ package
  - isolated back surface
  - low coupling capacity between pins and heatsink
  - enlarged creepage towards heatsink
  - application friendly pinout
  - low inductive current path
  - high reliability
  - industry standard outline
  - UL registered, E 72873

Applications

- single phaseleg
  - buck-boost chopper
- H bridge
  - power supplies
  - induction heating
  - four quadrant DC drives
  - controlled rectifier
- three phase bridge
  - AC drives
  - controlled rectifier

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Diodes

Symbol	Conditions	Maximum Ratings	
I_{F25}	T_C = 25°C	25	A
I_{F90}	T_C = 90°C	15	A

Symbol	Conditions	Characteristic Values min.	typ.	max.	
V_F	I_F = 20 A; T_{VJ} = 25°C		2.5	3.0	V
	T_{VJ} = 125°C		1.9		V
I_{RM}	I_F = 15 A; di_F/dt = -400 A/µs; T_{VJ} = 125°C		16		A
t_{rr}	V_R = 600 V; V_{GE} = 0 V		130		ns
R_{thJC}	(per diode)			2.3	K/W
R_{thCH}	with heat transfer paste		3.6		K/W

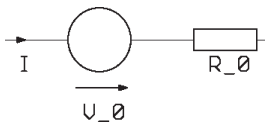
Component

Symbol	Conditions	Maximum Ratings	
T_{VJ}		-55...+150	°C
T_{stg}		-55...+125	°C
V_{ISOL}	$I_{ISOL} \leq$ 1 mA; 50/60 Hz	2500	V~
F_C	mounting force with clip	20...120	N

Symbol	Conditions	Characteristic Values min.	typ.	max.	
C_p	coupling capacity between shorted pins and mounting tab in the case		40		pF
d_S,d_A	pin - pin	1.7			mm
d_S,d_A	pin - backside metal	5.5			mm
Weight			9		g

Equivalent Circuits for Simulation

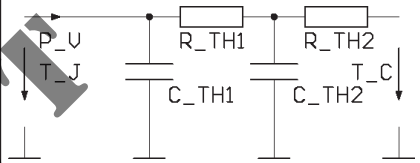
Conduction



IGBT (typ. at V_{GE} = 15 V; T_J = 125°C)
V_0 = 1.09 V; R_0 = 85 mΩ

Free Wheeling Diode (typ. at T_J = 125°C)
V_0 = 1.3 V; R_0 = 32 mΩ

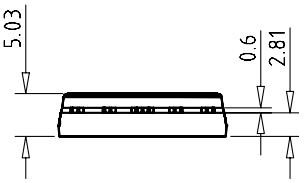
Thermal Response

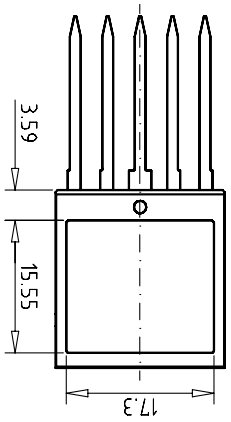


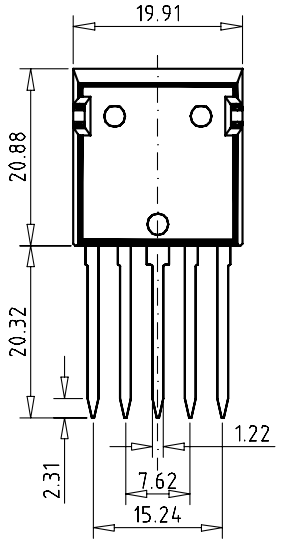
IGBT (typ.)
C_{th1} = 0.049 J/K; R_{th1} = 0.15 K/W
C_{th2} = 0.133 J/K; R_{th2} = 0.65 K/W

Free Wheeling Diode (typ.)
C_{th1} = 0.021 J/K; R_{th1} = 0.63 K/W
C_{th2} = 0.052 J/K; R_{th2} = 1.67 K/W

Dimensions in mm (1 mm = 0.0394")







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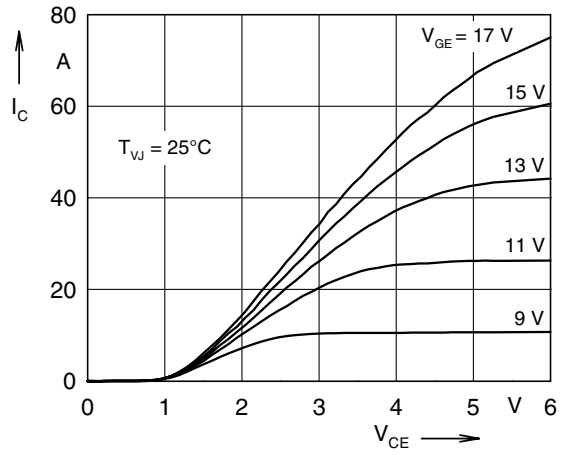

Fig. 1 Typ. output characteristics

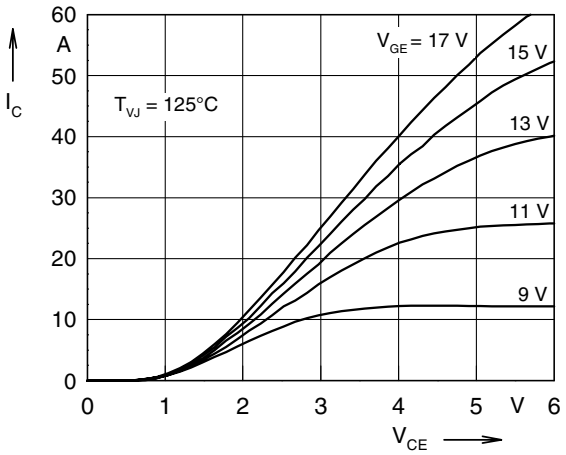

Fig. 2 Typ. output characteristics

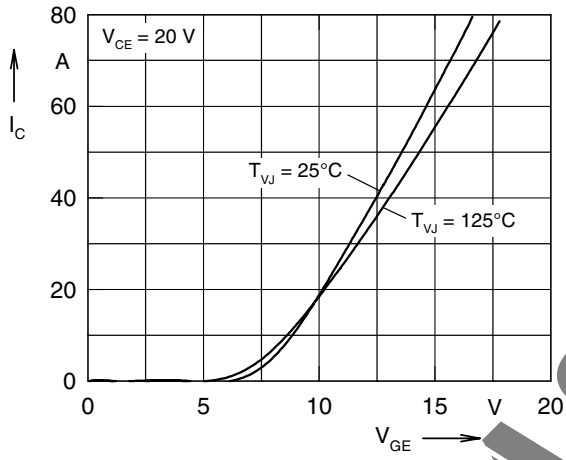

Fig. 3 Typ. transfer characteristics

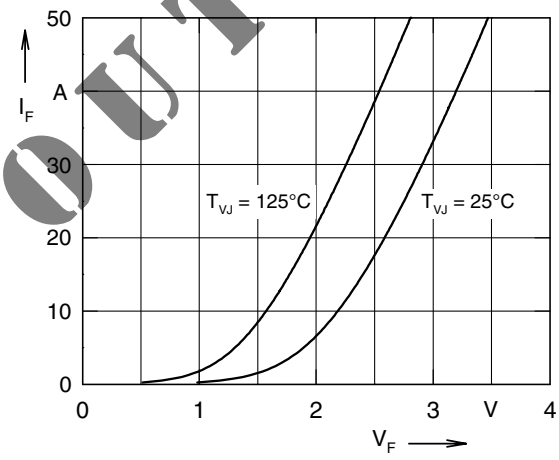

Fig. 4 Typ. forward characteristics of free wheeling diode

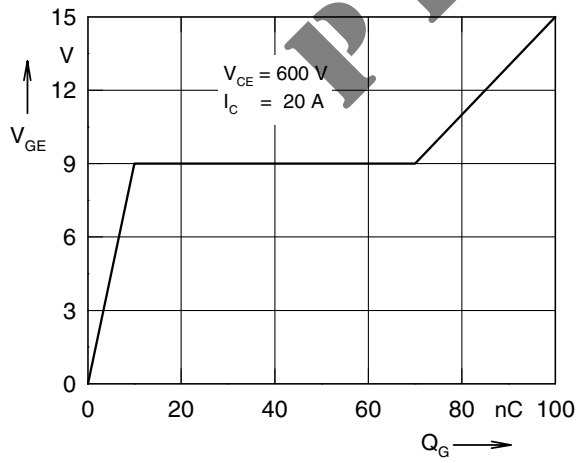

Fig. 5 Typ. turn on gate charge

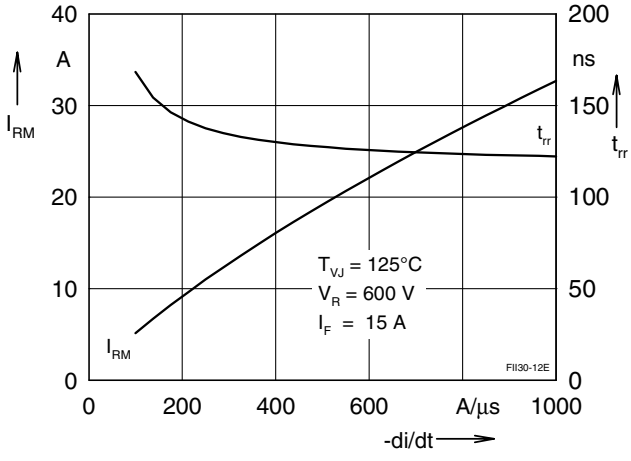

Fig. 6 Typ. turn off characteristics of free wheeling diode

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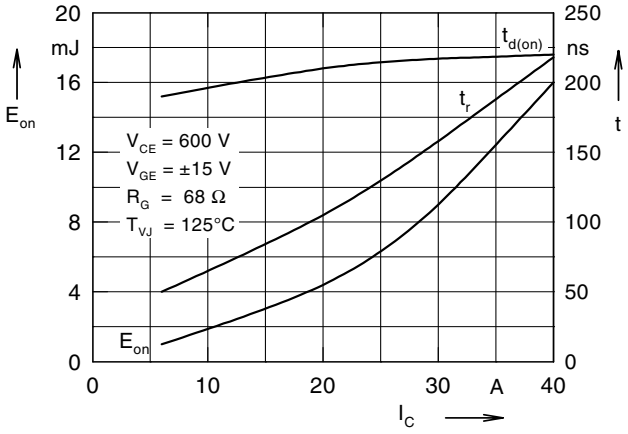

Fig. 7 Typ. turn on energy and switching times versus collector current

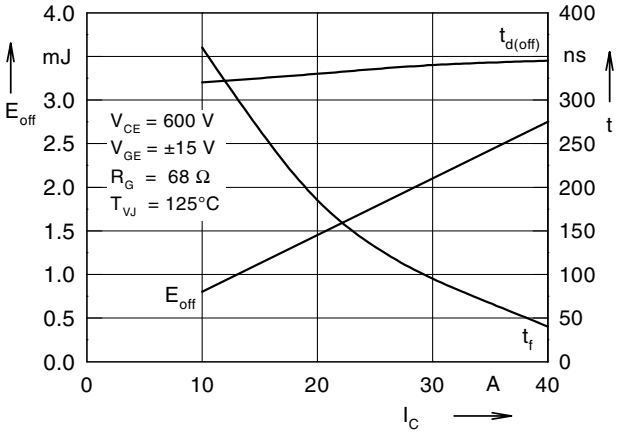

Fig. 8 Typ. turn off energy and switching times versus collector current

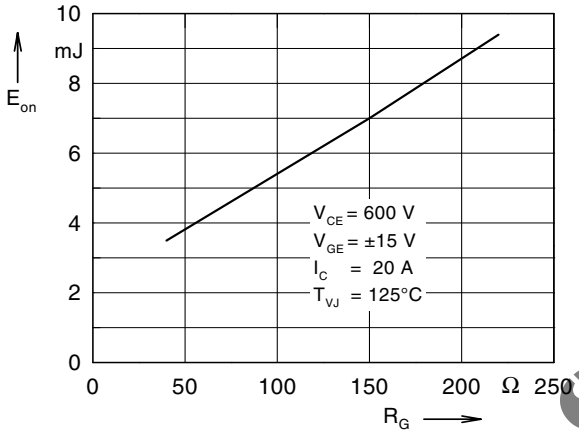

Fig. 9 Typ. turn on energy vs gate resistor

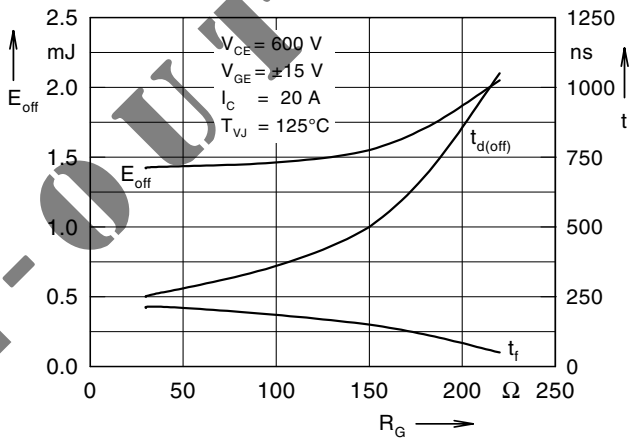

Fig.10 Typ. turn off energy and switching times versus gate resistor

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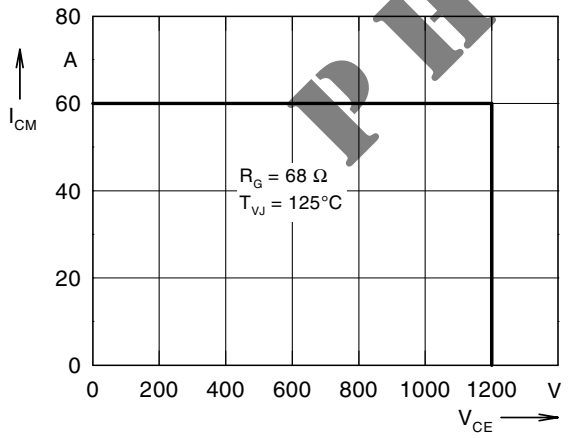

Fig. 11 Reverse biased safe operating area RBSOA

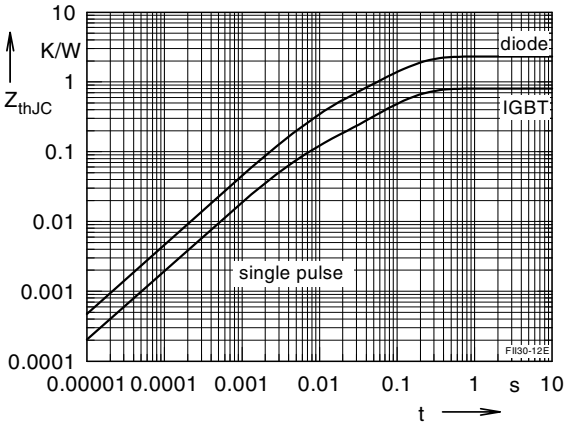

Fig. 12 Typ. transient thermal impedance

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