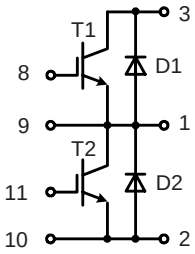
IGBT Module

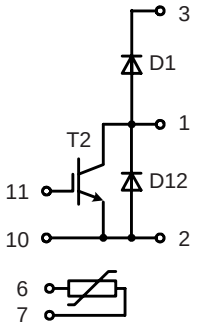
phaseleg and chopper topolgies
with optional temperature sensor

I_{C25} = 420 A
V_{CES} = 1200 V
$V_{CE(sat)\ typ.}$ = 2.2 V

MII 400-12E4

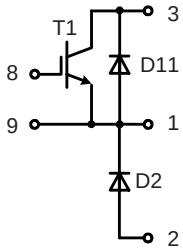


MID 400-12E4
MID 400-12E4T



NTC for ...T version only

MDI 400-12E4



IGBTs T1-T2

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	420	A
I_{C80}	T_C = 80°C	300	A
I_{CM}	V_{GE} = ±15 V; R_G = 4.7 Ω; T_{VJ} = 125°C	450	A
V_{CEK}	**RBSOA**, Clamped inductive load; L = 100 µH	V_{CES}	
t_{SC} **(SCSOA)**	V_{CE} = 900 V; V_{GE} = ±15 V; R_G = 4.7 Ω; T_{VJ} = 125°C non repetitive	10	µs
P_{tot}	T_C = 25°C	1700	W

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
$V_{CE(sat)}$	I_C = 300 A; V_{GE} = 15 V; T_{VJ} = 25°C		2.2	2.8	V
	T_{VJ} = 125°C		2.6		V
$V_{GE(th)}$	I_C = 10 mA; V_{GE} = V_{CE}	4.5		6.5	V
I_{CES}	V_{CE} = V_{CES}; V_{GE} = 0 V; T_{VJ} = 25°C		0.8	3.3	mA
	T_{VJ} = 125°C		3.5		mA
I_{GES}	V_{CE} = 0 V; V_{GE} = ± 20 V			600	nA
$t_{d(on)}$	Inductive load, T_{VJ} = 125°C		150		ns
t_r	V_{CE} = 600 V; I_C = 300 A		60		ns
$t_{d(off)}$	V_{GE} = ±15 V; R_G = 4.7 Ω		680		ns
t_f			50		ns
E_{on}			36		mJ
E_{off}			30		mJ
C_{ies}	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MHz		17		nF
Q_{Gon}	V_{CE} = 600 V; V_{GE} = 15 V; I_C = 300 A		2.25		µC
R_{thJC}	(per IGBT)			0.08	K/W
R_{thJH}	with heatsink compound		0.15		K/W

Features

- NPT³ IGBT
  - low saturation voltage
  - positive temperature coefficient
  - fast switching
  - short tail current for optimized performance in resonant circuits
- HiPerFRED™ diodes
  - fast and soft reverse recovery
  - low operating forward voltage
  - low leakage current
- NTC sensor for measurement of case temperature
- Package
  - low inductive current path
  - screw connection to high current main terminals
  - use of non interchangeable connectors for auxiliary terminals possible
  - kelvin emitter terminal for easy drive
  - isolated ceramic base plate

Applications

- drives
  - AC
  - DC
- power supplies
  - rectifiers with power factor correction and recuperation capability
  - UPS

302

Free wheeling diodes D1-D2

Symbol	Conditions	Maximum Ratings	
I_{F25}	T_C = 25°C	450	A
I_{F80}	T_C = 80°C	290	A

Symbol	Conditions	Characteristic Values min.	typ.	max.	
V_F	I_F = 300 A; V_{GE} = 0 V; T_{VJ} = 25°C		2.3	2.7	V
	T_{VJ} = 125°C		1.7		V
I_{RM}	I_F = 225 A; di_F/dt = -2000 A/µs; T_{VJ} = 125°C		200		A
t_{rr}	V_R = 600 V; V_{GE} = 0 V		220		ns
R_{thJC}	(per diode)			0.15	K/W
R_{thJH}	with heatsink compound		0.3		K/W

Chopper anti parallel diodes D11-D12

Symbol	Conditions	Maximum Ratings	
I_{F25}	T_C = 25°C	150	A
I_{F80}	T_C = 80°C	95	A

Symbol	Conditions	Characteristic Values min.	typ.	max.	
V_F	I_F = 100 A; V_{GE} = 0 V; T_{VJ} = 25°C		2.3	2.7	V
	T_{VJ} = 125°C		1.7		V
I_{RM}	I_F = 75 A; di_F/dt = -750 A/µs; T_{VJ} = 125°C		80		A
t_{rr}	V_R = 600 V; V_{GE} = 0 V		220		ns
R_{thJC}	(per diode)			0.45	K/W
R_{thJH}	with heatsink compound		0.9		K/W

Temperature Sensor NTC (...T version only)

Symbol	Conditions	Characteristic Values min.	typ.	max.	
R_{25}	T = 25°C $\left\{R(T) = R_{25} \cdot e^{B_{25/100}\left(\frac{1}{T} - \frac{1}{298K}\right)}\right\}$		2057		Ω
$B_{25/100}$			3560		K

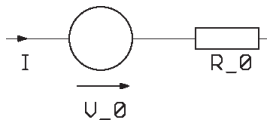
Module

Symbol	Conditions		Maximum Ratings	
T_{VJ}			-40...+150	°C
T_{stg}			-40...+125	°C
V_{ISOL}	I_{ISOL} ≤ 1 mA; 50/60 Hz		4000	V~
M_d	Mounting torque	(module, M6)	2.25 - 2.75	Nm
		(terminals, M6)	4.5 - 5.5	Nm

Symbol	Conditions	Characteristic Values min.	typ.	max.	
d_S	Creepage distance on surface	2			mm
d_A	Strike distance in air	2			mm
Weight			250		g

Equivalent Circuits for Simulation

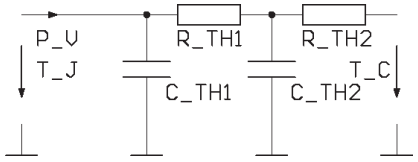
Conduction



IGBT (typ. at V_{GE} = 15 V; T_J = 125°C)
V_0 = 1.0 V; R_0 = 5.3 mΩ

Free Wheeling Diode D1-D2 (typ. at T_J=125°C)
V_0 = 1.3 V; R_0 = 1.3 mΩ

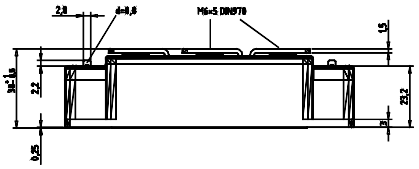
Thermal Response

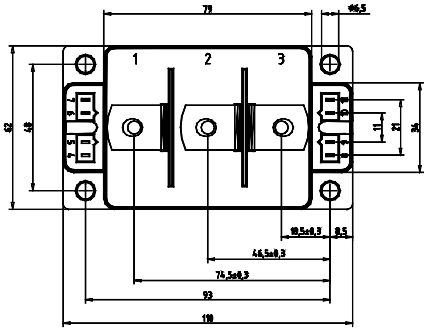


IGBT (typ.)
C_{th1} = 0.52 J/K; R_{th1} = 0.078 K/W
C_{th2} = 1.29 J/K; R_{th2} = 0.002 K/W

Free Wheeling Diode D1-D2 (typ.)
C_{th1} = 0.43 J/K; R_{th1} = 0.147 K/W
C_{th2} = 0.79 J/K; R_{th2} = 0.003 K/W

Dimensions in mm (1 mm = 0.0394")





Optional accessories for modules

keyed twin plugs
(UL758, style 1385, CSA class 5851, guide 460-1-1)

- Type ZY180L with wire length 350mm
  – for pins 4 (yellow wire) and 5 (red wire)
  – for pins 11 (yellow wire) and 10 (red wire)
- Type ZY180R with wire length 350mm
  – for pins 7 (yellow wire) and 6 (red wire)
  – for pins 8 (yellow wire) and 9 (red wire)

302

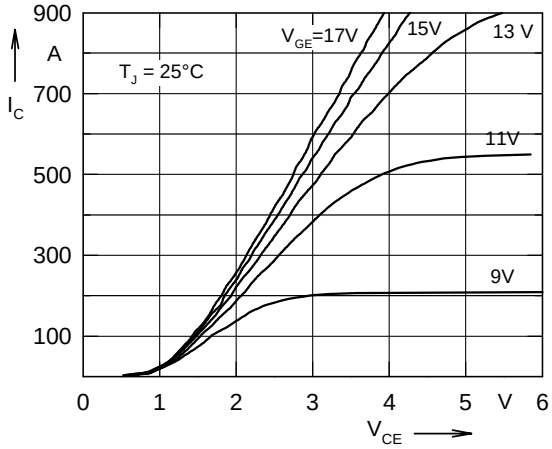


Fig. 1 Typ. output characteristics

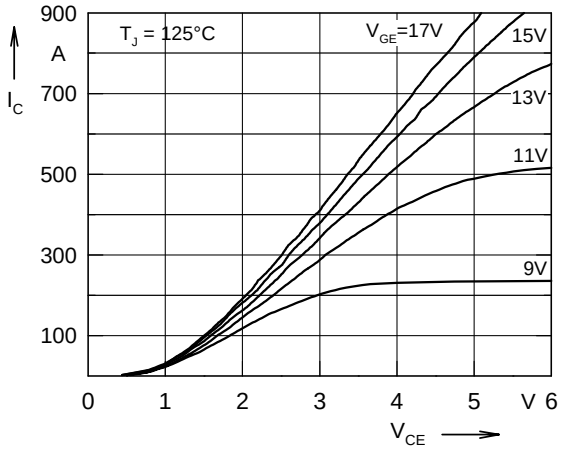


Fig. 2 Typ. output characteristics

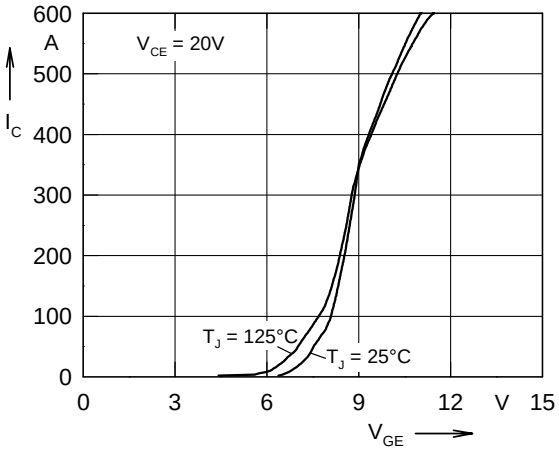


Fig. 3 Typ. transfer characteristics

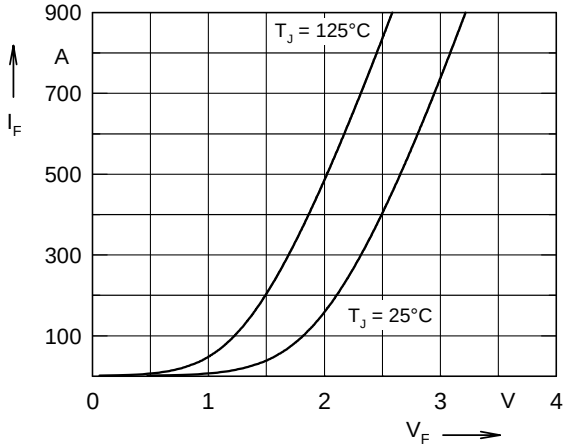


Fig. 4 Typ. forward characteristics of free wheeling diode D1-D2

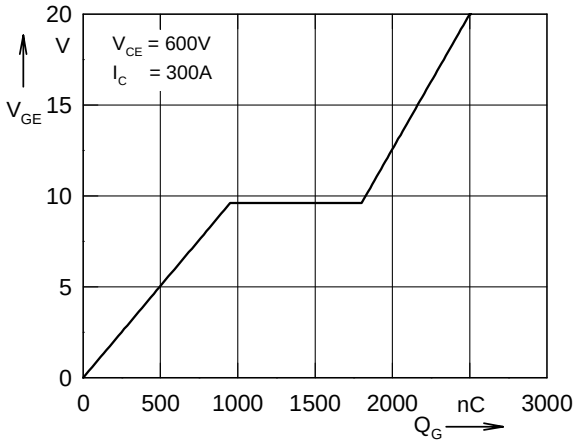


Fig. 5 Typ. turn on gate charge

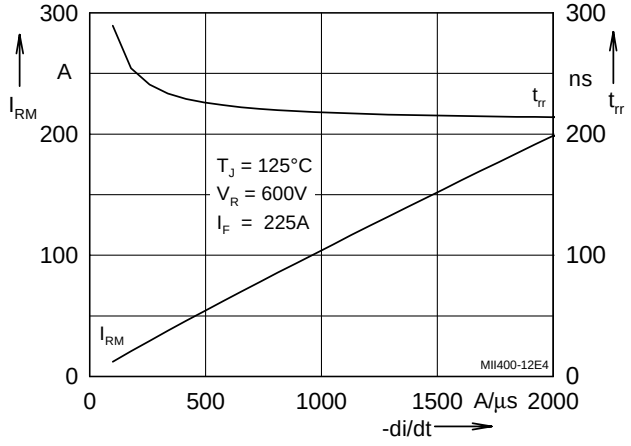


Fig. 6 Typ. turn off characteristics of free wheeling diode D1-D2

302

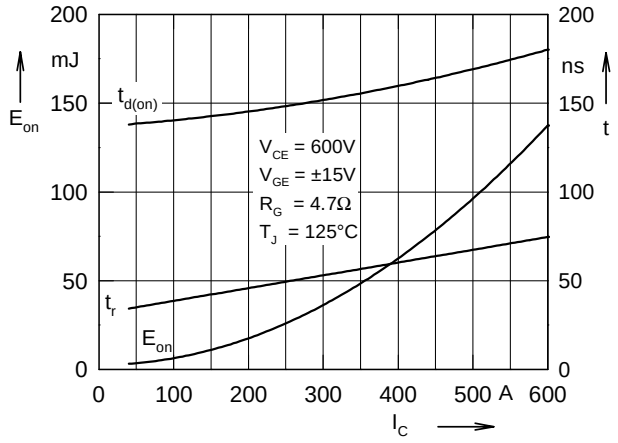


Fig. 7 Typ. turn on energy and switching times versus collector current

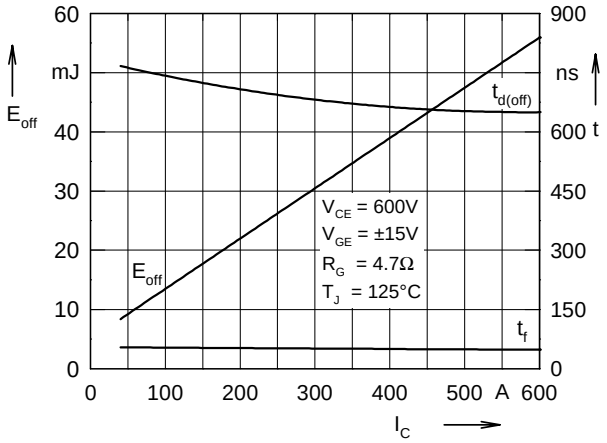


Fig. 8 Typ. turn off energy and switching times versus collector current

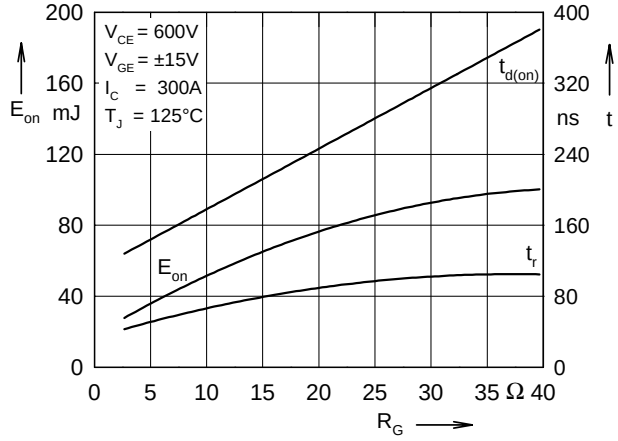


Fig. 9 Typ. turn on energy and switching times versus gate resistor

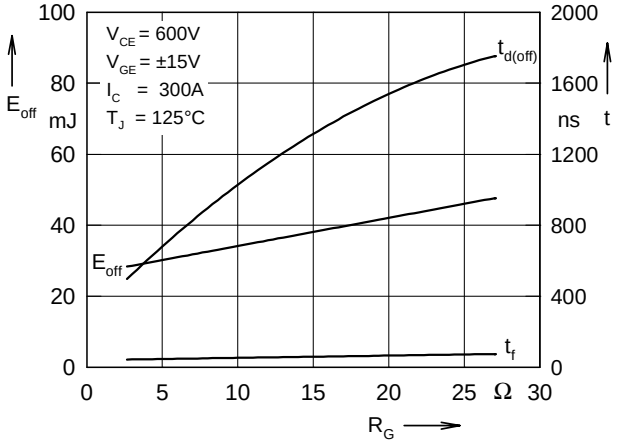


Fig.10 Typ. turn off energy and switching times versus gate resistor

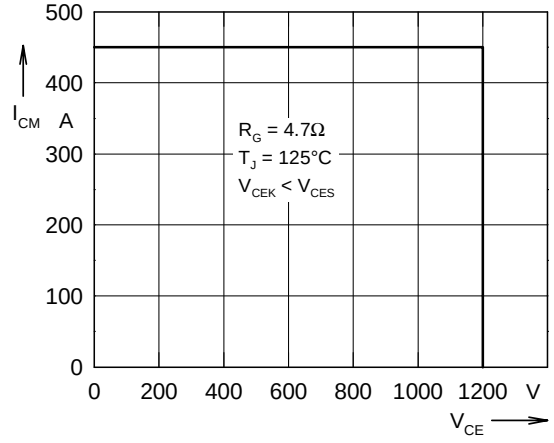


Fig. 11 Reverse biased safe operating area RBSOA

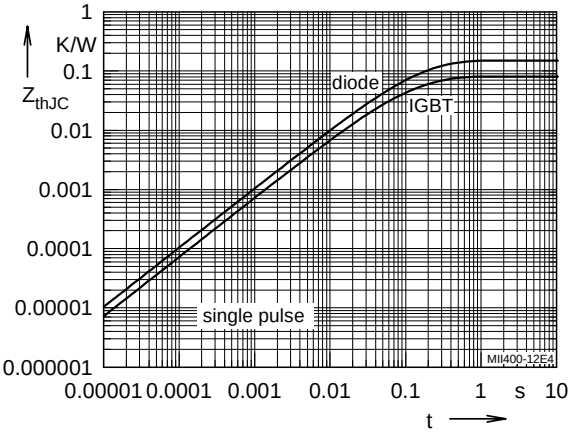


Fig. 12 Typ. transient thermal impedance