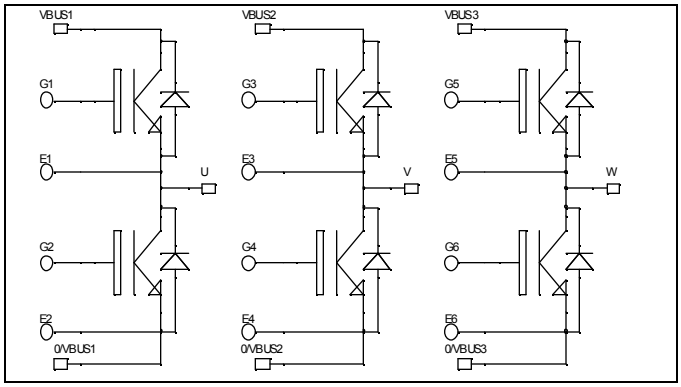
Triple phase leg PT IGBT Power Module

V_{CES} = 1200V
I_C = 40A @ Tc = 80°C

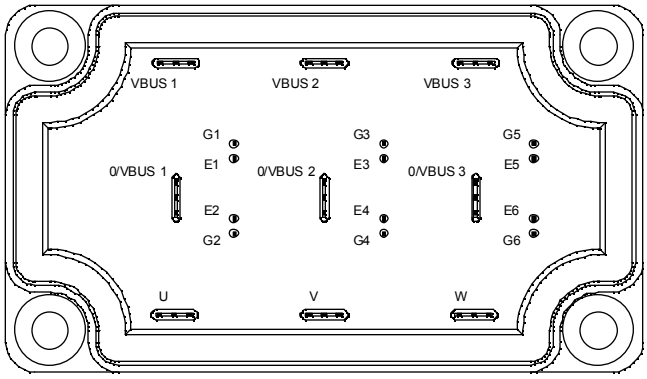


Application

- Welding converters
- Switched Mode Power Supplies
- Uninterruptible Power Supplies
- Motor control

Features

- Power MOS 7® Punch Through (PT) IGBT
  - Low conduction loss
  - Ultra fast tail current shutoff
  - Low gate charge
  - Switching frequency capability in the 200kHz range
  - Soft recovery parallel diodes
  - Low diode VF
- Kelvin emitter for easy drive
- Very low stray inductance
  - Symmetrical design
  - Lead frames for power connections
- High level of integration



Benefits

- Outstanding performance at high frequency operation
- Direct mounting to heatsink (isolated package)
- Low junction to case thermal resistance
- Solderable terminals both for power and signal for easy PCB mounting
- Very low (12mm) profile
- Each leg can be easily paralleled to achieve a phase leg of three times the current capability
- Module can be configured as a three phase bridge
- Module can be configured as a boost followed by a full bridge

Absolute maximum ratings

Symbol	*Parameter*		*Max ratings*	*Unit*
V_{CES}	Collector - Emitter Breakdown Voltage		1200	V
I_C	Continuous Collector Current	T_c = 25°C	64	A
		T_c = 80°C	40	
I_{CM}	Pulsed Collector Current	T_c = 25°C	160	
V_{GE}	Gate – Emitter Voltage		±20	V
P_D	Maximum Power Dissipation	T_c = 25°C	277	W
SSOA	Switching Safe Operating Area	T_j = 150°C	170A @ 960V	

CAUTION: These Devices are sensitive to Electrostatic Discharge. Proper Handing Procedures Should Be Followed.

All ratings @ T_j = 25°C unless otherwise specified

Electrical Characteristics

Symbol	*Characteristic*	*Test Conditions*		*Min*	*Typ*	*Max*	*Unit*
BV_{CES}	Collector - Emitter Breakdown Voltage	V_{GE} = 0V, I_C = 500µA		1200			V
I_{CES}	Zero Gate Voltage Collector Current	V_{GE} = 0V V_{CE} = 1200V	T_j = 25°C			500	µA
			T_j = 125°C			2500	
$V_{CE(on)}$	Collector Emitter on Voltage	V_{GE} =15V I_C = 40A	T_j = 25°C		3.3	3.9	V
			T_j = 125°C		3.0		
$V_{GE(th)}$	Gate Threshold Voltage	V_{GE} = V_{CE}, I_C = 1mA		3		6	V
I_{GES}	Gate – Emitter Leakage Current	V_{GE} = ±20V, V_{CE} = 0V				±100	nA

Dynamic Characteristics

Symbol	*Characteristic*	*Test Conditions*	*Min*	*Typ*	*Max*	*Unit*
C_{ies}	Input Capacitance	V_{GE} = 0V V_{CE} = 25V f = 1MHz		3935		pF
C_{oes}	Output Capacitance			300		
C_{res}	Reverse Transfer Capacitance			55		
Q_g	Total gate Charge	V_{GE} = 15V V_{Bus} = 300V I_C = 40A		185		nC
Q_{ge}	Gate – Emitter Charge			25		
Q_{gc}	Gate – Collector Charge			80		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (25°C) V_{GE} = 15V V_{Bus} = 600V I_C = 40A R_G = 5Ω		18		ns
T_r	Rise Time			29		
$T_{d(off)}$	Turn-off Delay Time			102		
T_f	Fall Time			38		
E_{on1}	Turn-on Switching Energy			900		µJ
E_{on2}	Turn-on Switching Energy ❶			1869		
E_{off}	Turn-off Switching Energy ❷			904		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (125°C) V_{GE} = 15V V_{Bus} = 600V I_C = 40A R_G = 5Ω		18		ns
T_r	Rise Time			29		
$T_{d(off)}$	Turn-off Delay Time			151		
T_f	Fall Time			79		
E_{on1}	Turn-on Switching Energy			900		µJ
E_{on2}	Turn-on Switching Energy ❶			3078		
E_{off}	Turn-off Switching Energy ❷			2254		

❶ E_{on2} includes diode reverse recovery
❷ In accordance with JEDEC standard JESD24-1

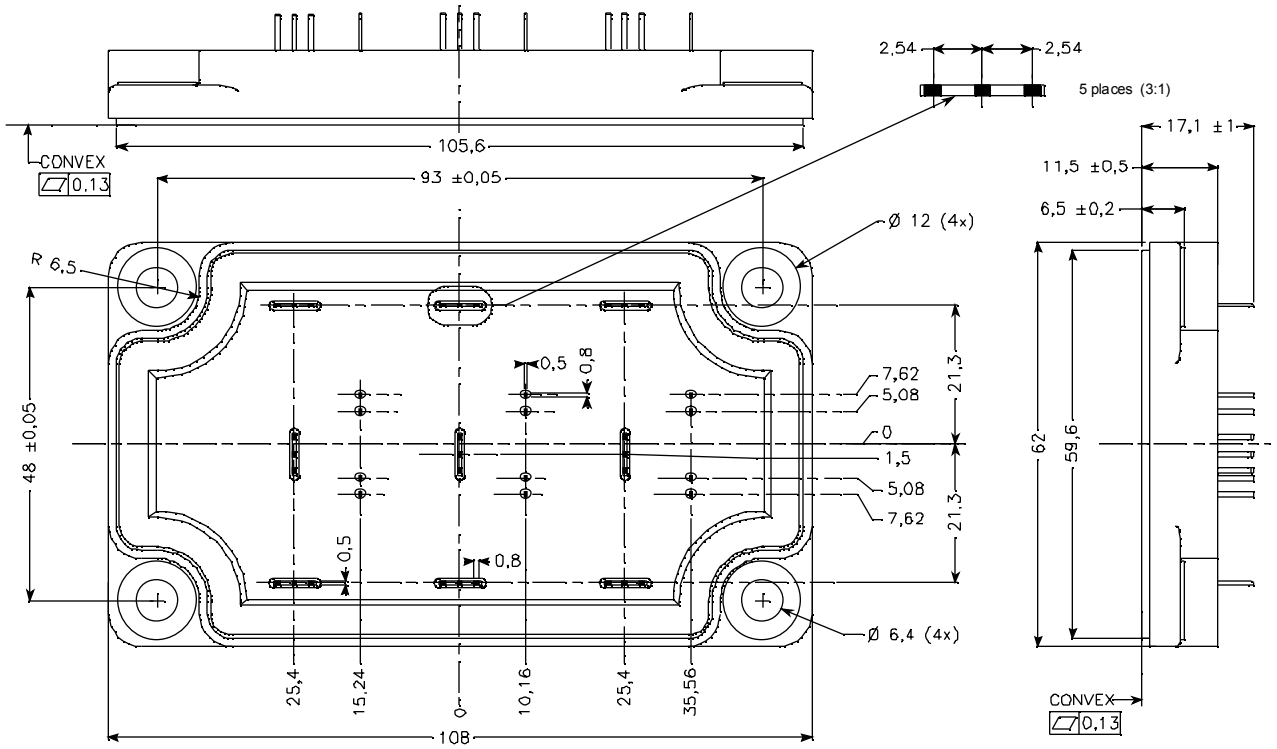
Reverse diode ratings and characteristics

Symbol	*Characteristic*	*Test Conditions*		*Min*	*Typ*	*Max*	*Unit*
V_{RRM}	Maximum Peak Repetitive Reverse Voltage			1200			V
I_{RM}	Maximum Reverse Leakage Current	V_R=1200V	T_j = 25°C			250	µA
			T_j = 125°C			500	
$I_{F(AV)}$	Maximum Average Forward Current	50% duty cycle	Tc = 80°C		25		A
V_F	Diode Forward Voltage	I_F = 25A V_{GE} = 0V	T_j = 25°C		2.3	2.8	V
			T_j = 125°C		1.8		
t_{rr}	Reverse Recovery Time	I_F = 25A V_R = 600V di/dt =800A/µs	T_j = 125°C		0.13		µs
Q_{rr}	Reverse Recovery Charge		T_j = 25°C		2.3		µC
			T_j = 125°C		6		

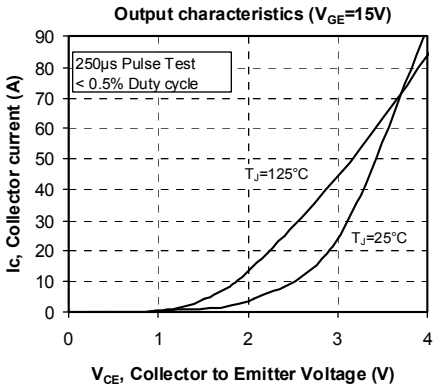
Thermal and package characteristics

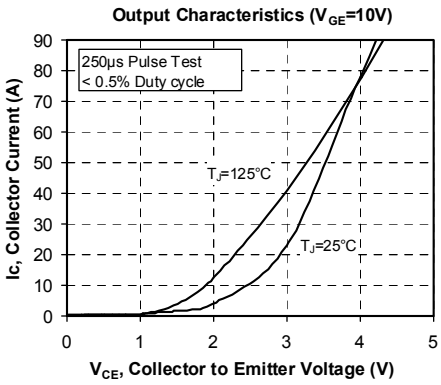
Symbol	*Characteristic*			*Min*	*Typ*	*Max*	*Unit*
R_{thJC}	Junction to Case		IGBT			0.45	°C/W
			Diode			1	
V_{ISOL}	RMS Isolation Voltage, any terminal to case t =1 min, I isol<1mA, 50/60Hz			2500			V
T_J	Operating junction temperature range			-40		150	°C
T_{STG}	Storage Temperature Range			-40		125	
T_C	Operating Case Temperature			-40		100	
Torque	Mounting torque	To heatsink	M6	3		5	N.m
Wt	Package Weight					250	g

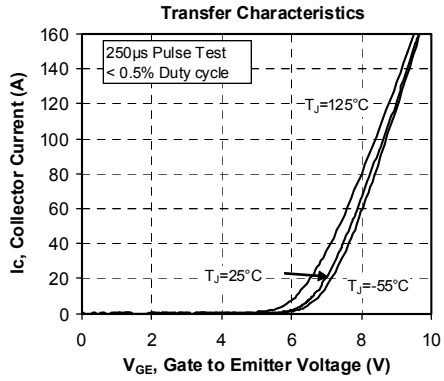
Package outline

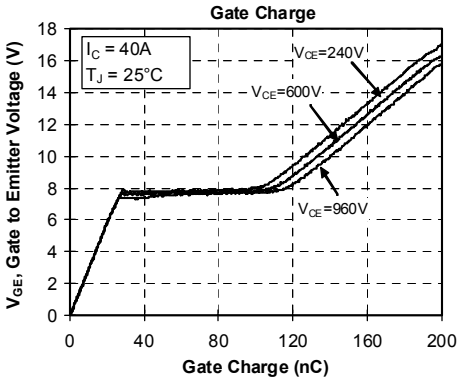


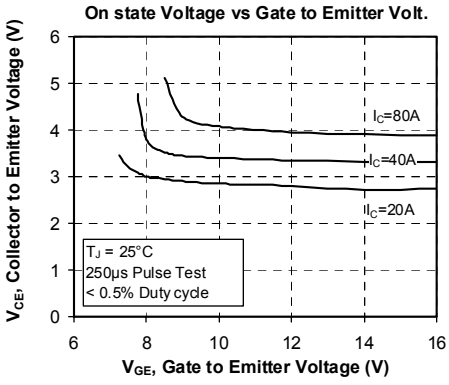
Typical Performance Curve

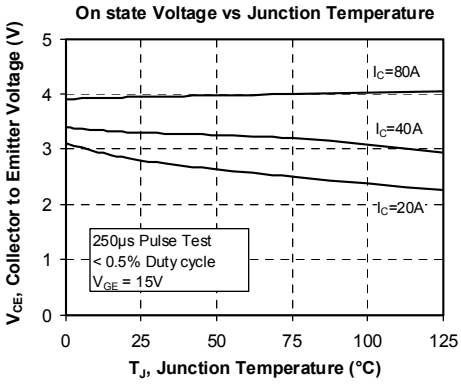


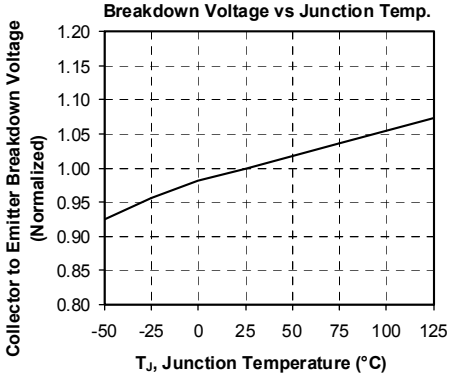


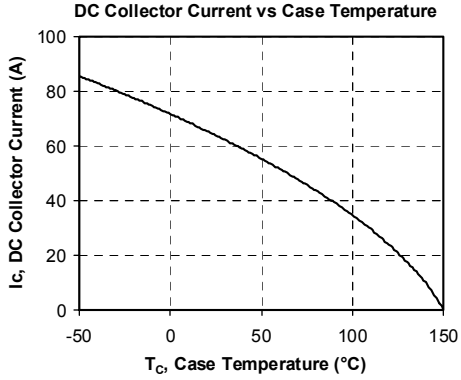




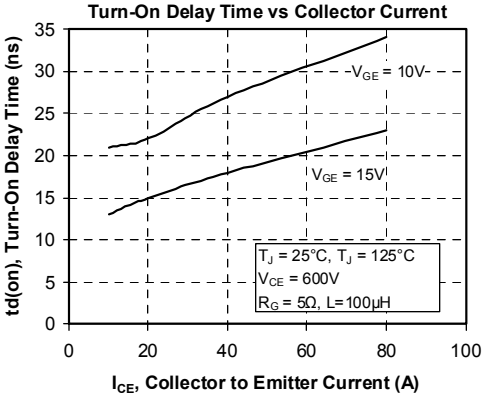




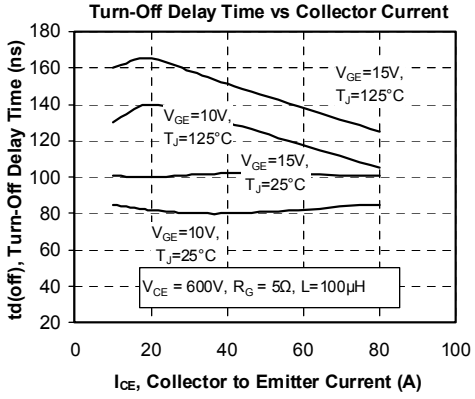




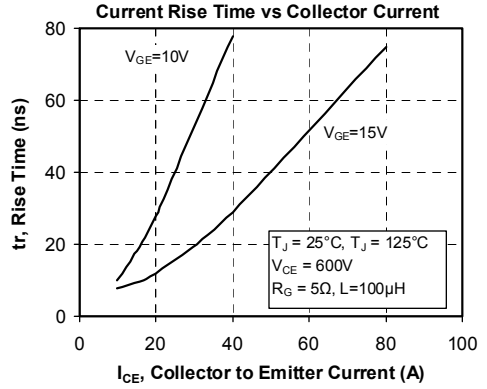
Turn-On Delay Time vs Collector Current



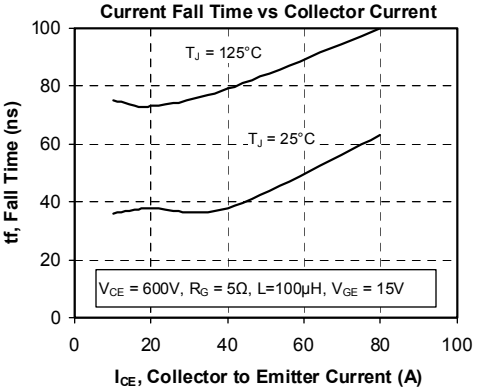
Turn-Off Delay Time vs Collector Current



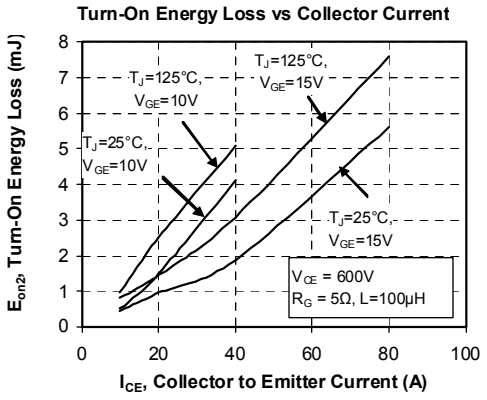
Current Rise Time vs Collector Current



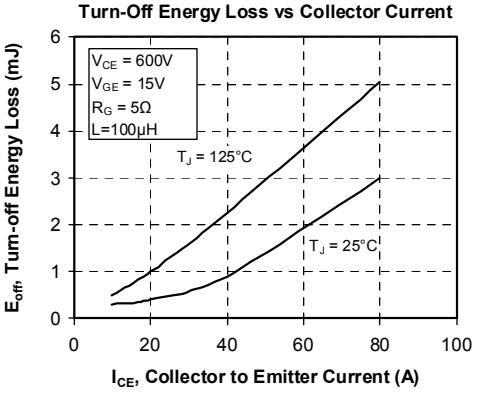
Current Fall Time vs Collector Current



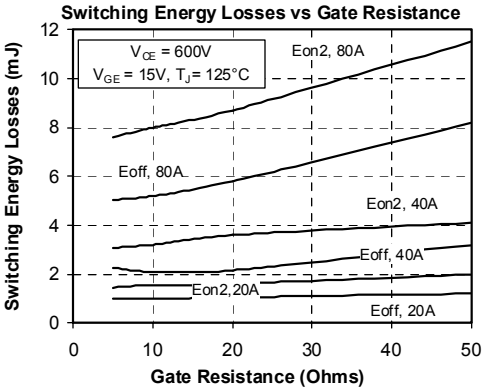
Turn-On Energy Loss vs Collector Current



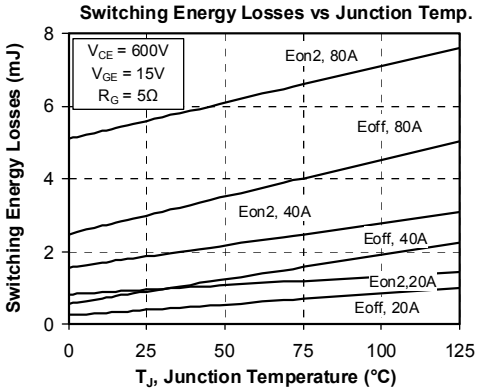
Turn-Off Energy Loss vs Collector Current



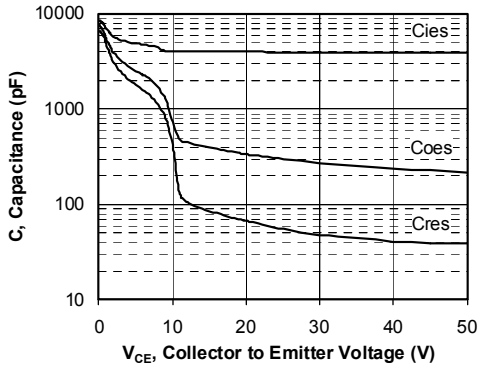
Switching Energy Losses vs Gate Resistance



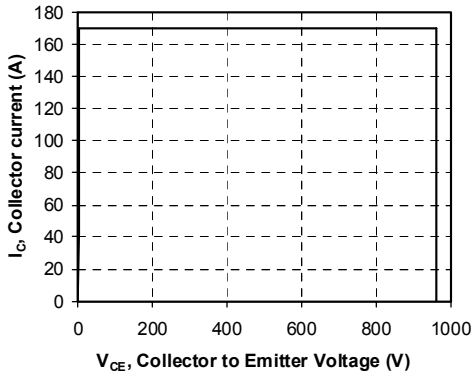
Switching Energy Losses vs Junction Temp.



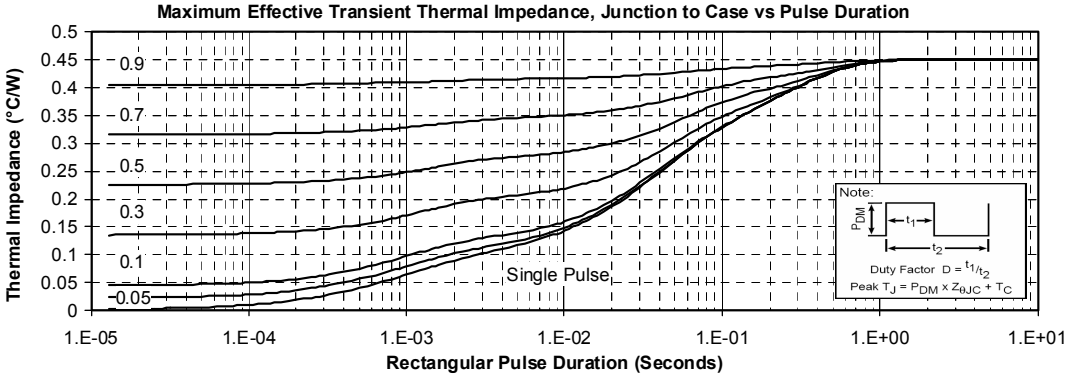
Capacitance vs Collector to Emitter Voltage



Minimum Switching Safe Operating Area



Maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration



Operating Frequency vs Collector Current