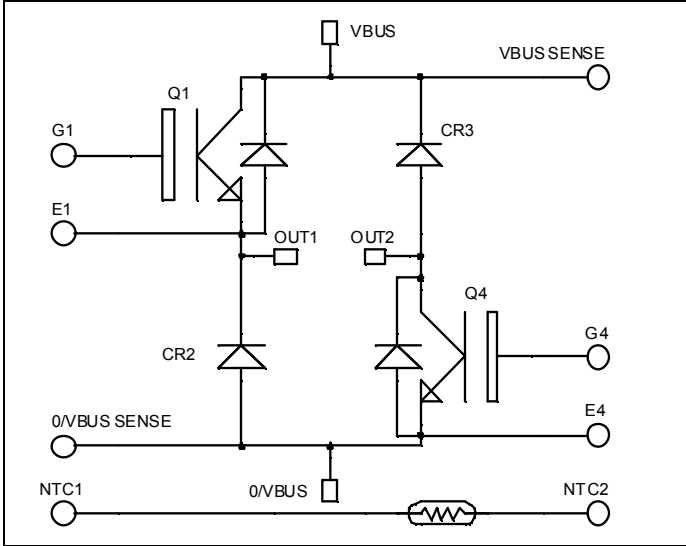


## Asymmetrical - Bridge NPT IGBT Power Module

$V_{CES} = 600V$   
 $I_C = 50A @ T_c = 80^\circ C$

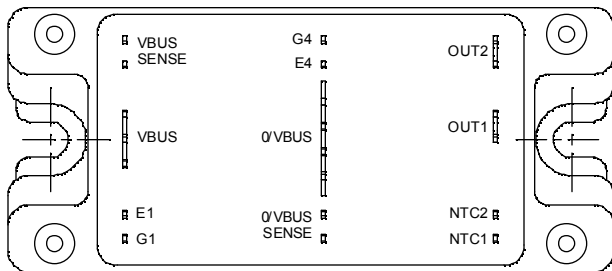


### Application

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

### Features

- Non Punch Through (NPT) Fast IGBT®
  - Low voltage drop
  - Low tail current
  - Switching frequency up to 100 kHz
  - Soft recovery parallel diodes
  - Low diode  $V_F$
  - Low leakage current
  - Avalanche energy rated
  - RBSOA and SCSOA rated
- Kelvin emitter for easy drive
- Very low stray inductance
  - Symmetrical design
  - Lead frames for power connections
- Internal thermistor for temperature monitoring
- High level of integration



### Benefits

- Outstanding performance at high frequency operation
- Stable temperature behavior
- Very rugged
- Direct mounting to heatsink (isolated package)
- Low junction to case thermal resistance
- Solderable terminals both for power and signal for easy PCB mounting
- Easy paralleling due to positive TC of  $V_{CESat}$
- Low profile
- RoHS compliant

### Absolute maximum ratings

Symbol	Parameter	Max ratings	Unit
$V_{CES}$	Collector - Emitter Breakdown Voltage	600	V
$I_C$	Continuous Collector Current	$T_C = 25^\circ C$	65
		$T_C = 80^\circ C$	50
$I_{CM}$	Pulsed Collector Current	$T_C = 25^\circ C$	230
$V_{GE}$	Gate - Emitter Voltage	$\pm 20$	V
$P_D$	Maximum Power Dissipation	$T_C = 25^\circ C$	250
RBSOA	Reverse Bias Safe Operating Area	$T_j = 125^\circ C$	100A@500V

**CAUTION:** These Devices are sensitive to Electrostatic Discharge. Proper Handling Procedures Should Be Followed. See application note APT0502 on [www.microsemi.com](http://www.microsemi.com)

All ratings @  $T_j = 25^\circ\text{C}$  unless otherwise specified

**Electrical Characteristics**

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit	
$I_{CES}$	Zero Gate Voltage Collector Current	$V_{GE} = 0\text{V}$ $V_{CE} = 600\text{V}$	$T_j = 25^\circ\text{C}$			250	$\mu\text{A}$
			$T_j = 125^\circ\text{C}$			500	
$V_{CE(sat)}$	Collector Emitter Saturation Voltage	$V_{GE} = 15\text{V}$ $I_C = 50\text{A}$	$T_j = 25^\circ\text{C}$	1.7	2.0	2.45	V
			$T_j = 125^\circ\text{C}$		2.2		
$V_{GE(th)}$	Gate Threshold Voltage	$V_{GE} = V_{CE}, I_C = 1\text{mA}$	4		6	V	
$I_{GES}$	Gate – Emitter Leakage Current	$V_{GE} = 20\text{V}, V_{CE} = 0\text{V}$			400	nA	

**Dynamic Characteristics**

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
$C_{ies}$	Input Capacitance	$V_{GE} = 0\text{V}$ $V_{CE} = 25\text{V}$ $f = 1\text{MHz}$		2200		pF
$C_{oes}$	Output Capacitance			323		
$C_{res}$	Reverse Transfer Capacitance			200		
$Q_g$	Total gate Charge	$V_{GE} = 15\text{V}$ $V_{Bus} = 300\text{V}$ $I_C = 50\text{A}$		166		nC
$Q_{ge}$	Gate – Emitter Charge			20		
$Q_{gc}$	Gate – Collector Charge			100		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching ( $25^\circ\text{C}$ ) $V_{GE} = 15\text{V}$ $V_{Bus} = 400\text{V}$ $I_C = 50\text{A}$ $R_G = 2.7\Omega$		40		ns
$T_r$	Rise Time			9		
$T_{d(off)}$	Turn-off Delay Time			120		
$T_f$	Fall Time			12		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching ( $125^\circ\text{C}$ ) $V_{GE} = 15\text{V}$ $V_{Bus} = 400\text{V}$ $I_C = 50\text{A}$ $R_G = 2.7\Omega$		42		ns
$T_r$	Rise Time			10		
$T_{d(off)}$	Turn-off Delay Time			130		
$T_f$	Fall Time			21		
$E_{on}$	Turn-on Switching Energy	$V_{GE} = 15\text{V}$ $V_{Bus} = 400\text{V}$ $I_C = 50\text{A}$ $R_G = 2.7\Omega$	$T_j = 125^\circ\text{C}$		0.5	mJ
$E_{off}$	Turn-off Switching Energy		$T_j = 125^\circ\text{C}$		1	

**Diode ratings and characteristics**

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit	
$V_{RRM}$	Maximum Peak Repetitive Reverse Voltage		600			V	
$I_{RM}$	Maximum Reverse Leakage Current	$V_R = 600\text{V}$	$T_j = 25^\circ\text{C}$			250	$\mu\text{A}$
			$T_j = 125^\circ\text{C}$			500	
$I_F$	DC Forward Current			60		A	
$V_F$	Diode Forward Voltage	$I_F = 60\text{A}$		1.6	1.8	V	
		$I_F = 120\text{A}$		1.9			
		$I_F = 60\text{A}$	$T_j = 125^\circ\text{C}$		1.4		
$t_{rr}$	Reverse Recovery Time	$I_F = 60\text{A}$ $V_R = 400\text{V}$	$T_j = 25^\circ\text{C}$		130	ns	
			$T_j = 125^\circ\text{C}$		170		
$Q_{rr}$	Reverse Recovery Charge	$di/dt = 200\text{A}/\mu\text{s}$	$T_j = 25^\circ\text{C}$		220	nC	
			$T_j = 125^\circ\text{C}$		920		

**Temperature sensor NTC** (see application note APT0406 on [www.microsemi.com](http://www.microsemi.com) for more information).

**Symbol Characteristic** **Min Typ Max Unit**

Symbol	Characteristic	Min	Typ	Max	Unit
R <sub>25</sub>	Resistance @ 25°C		50		kΩ
B <sub>25/85</sub>	T <sub>25</sub> = 298.15 K		3952		K

$$R_T = \frac{R_{25}}{\exp\left[B_{25/85}\left(\frac{1}{T_{25}} - \frac{1}{T}\right)\right]}$$

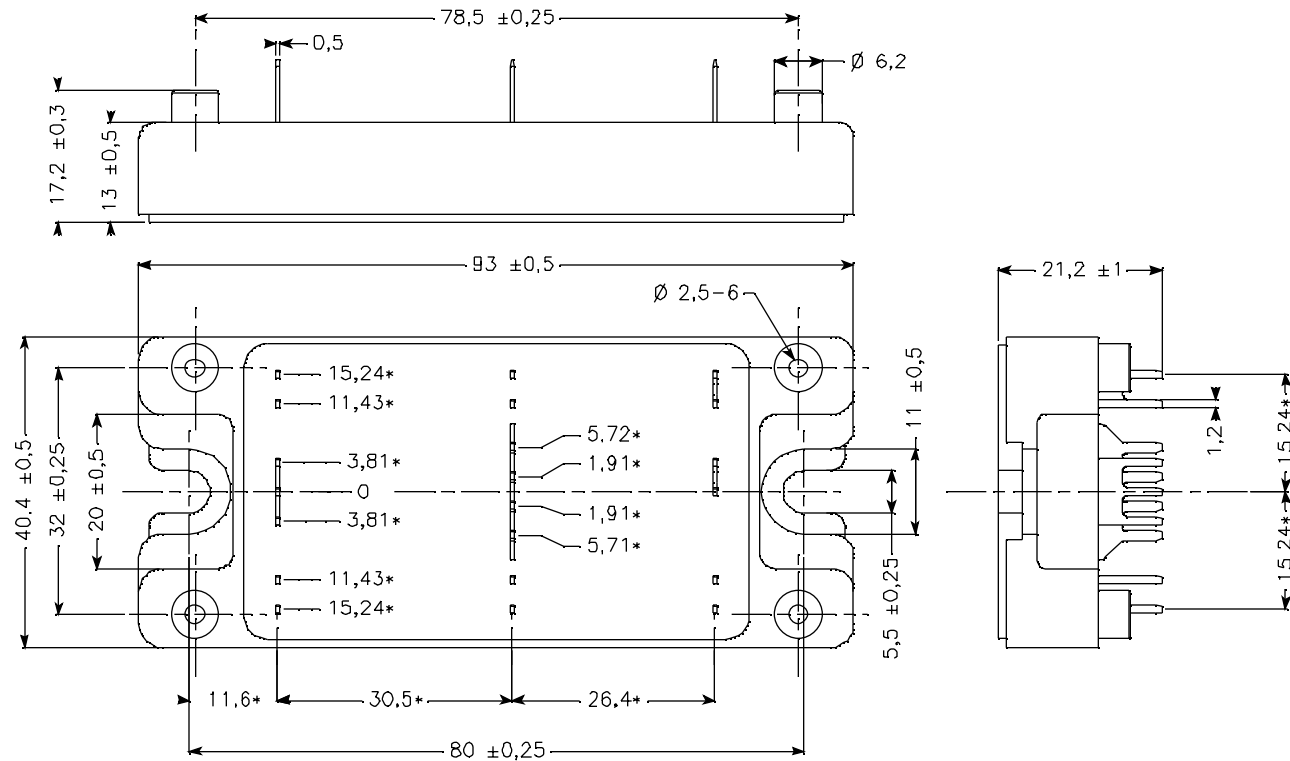
T: Thermistor temperature  
 R<sub>T</sub>: Thermistor value at T

## Thermal and package characteristics

**Symbol Characteristic** **Min Typ Max Unit**

Symbol	Characteristic	Min	Typ	Max	Unit		
R <sub>thJC</sub>	Junction to Case Thermal Resistance	IGBT		0.5	°C/W		
		Diode		0.9			
V <sub>ISOL</sub>	RMS Isolation Voltage, any terminal to case t=1 min, I <sub>isol</sub> <1mA, 50/60Hz	2500			V		
T <sub>J</sub>	Operating junction temperature range	-40		150	°C		
T <sub>STG</sub>	Storage Temperature Range	-40		125			
T <sub>C</sub>	Operating Case Temperature	-40		100			
Torque	Mounting torque		To heatsink	M5	2.5	4.7	N.m
Wt	Package Weight					160	g

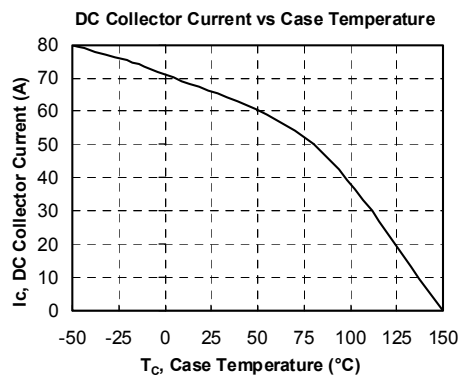
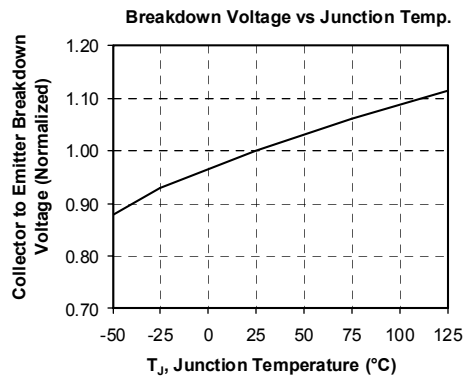
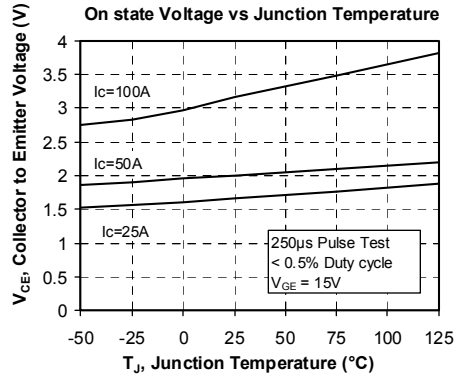
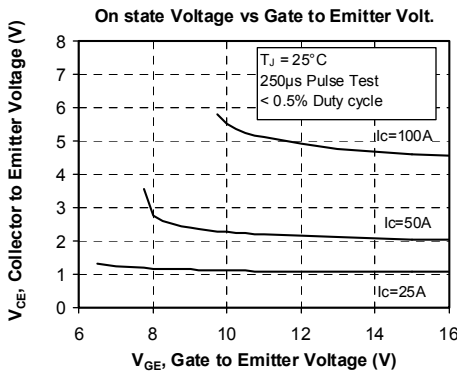
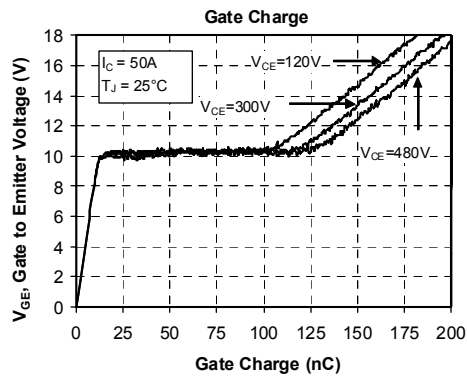
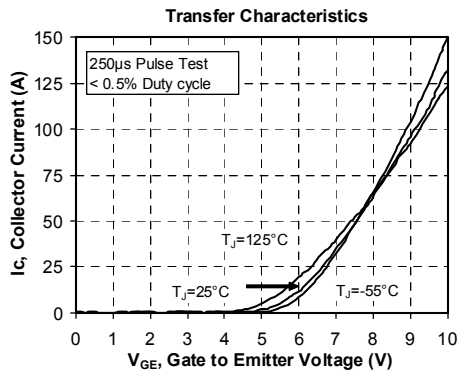
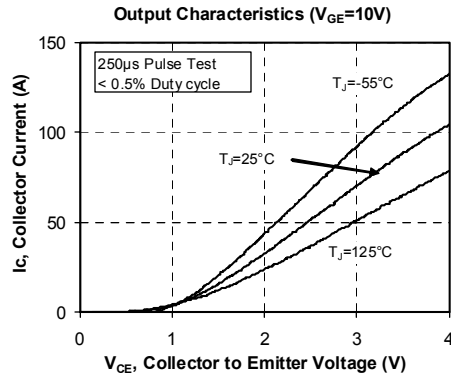
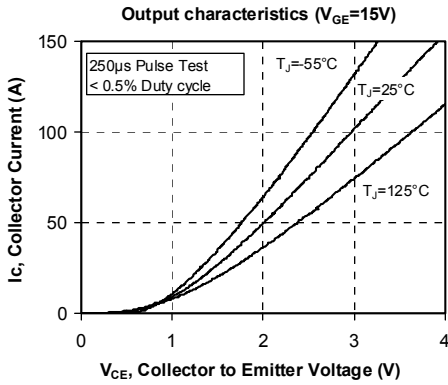
## SP4 Package outline (dimensions in mm)

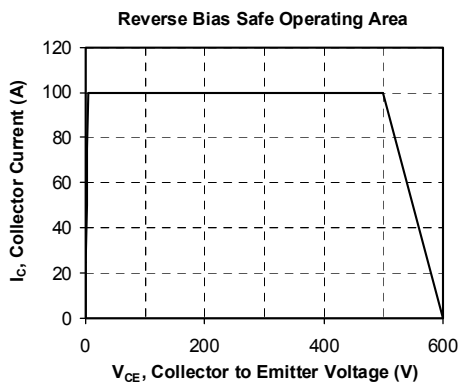
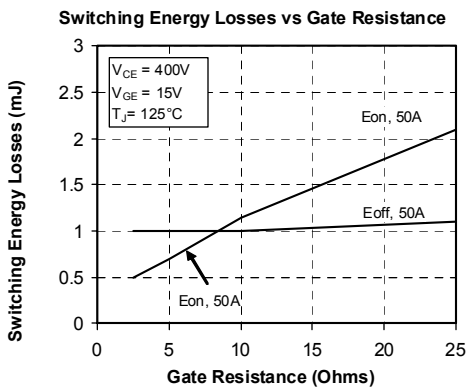
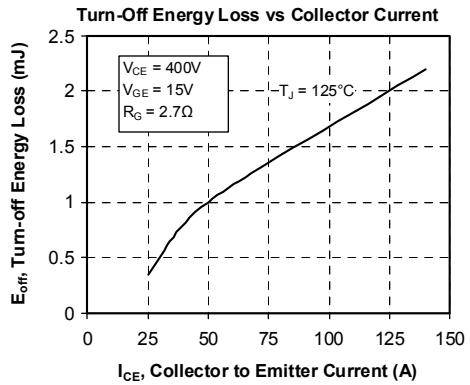
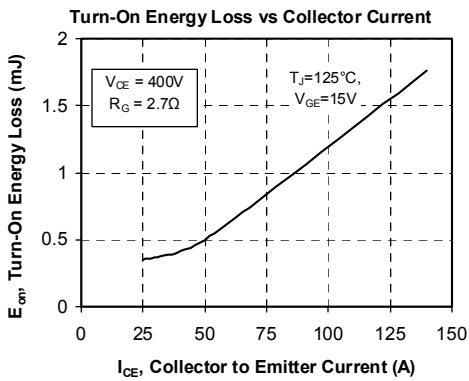
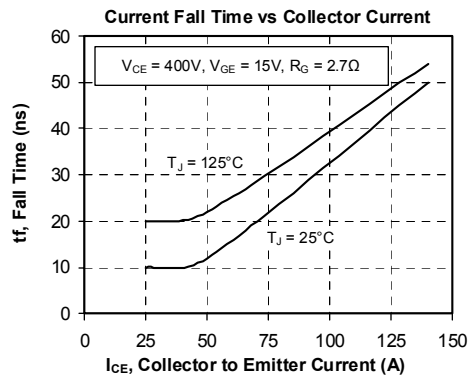
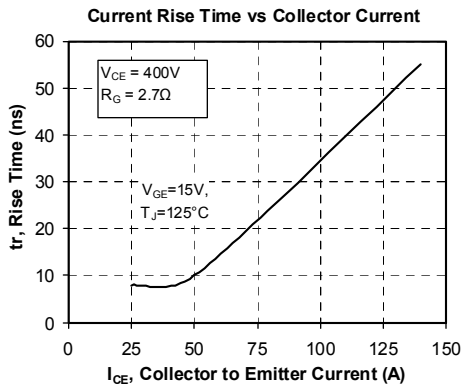
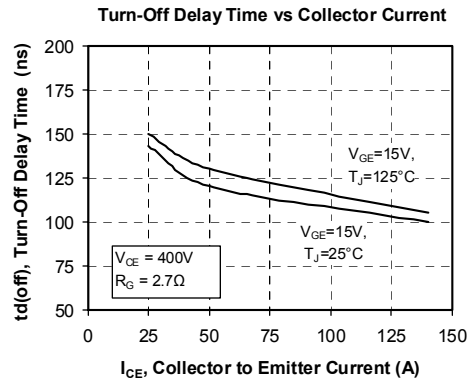
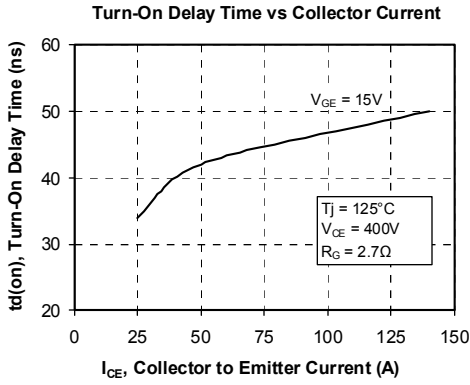


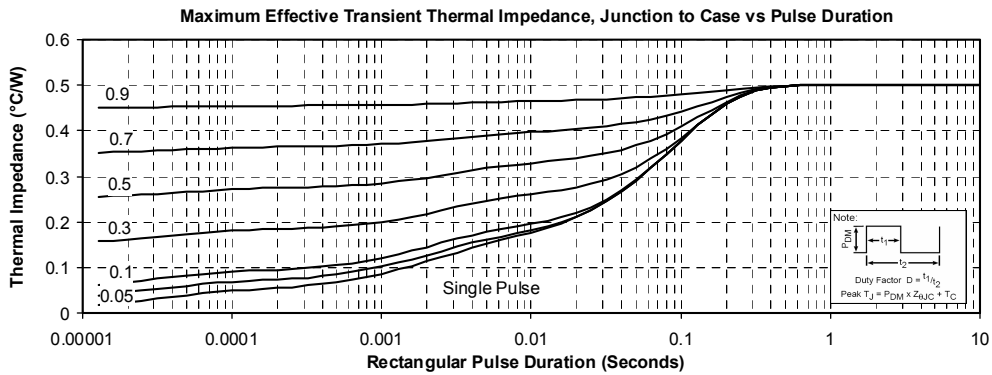
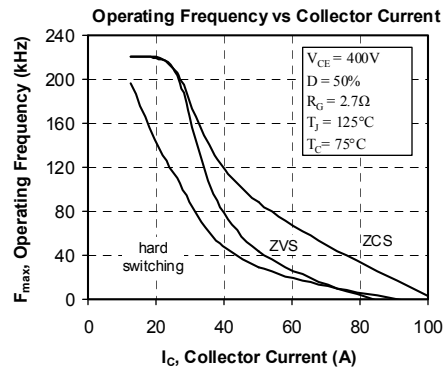
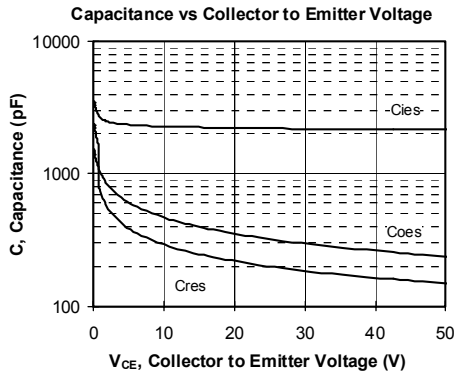
ALL DIMENSIONS MARKED "\*" ARE TOLERANCED AS:  $\pm 0,1$

See application note APT0501 - Mounting Instructions for SP4 Power Modules on [www.microsemi.com](http://www.microsemi.com)

## Typical Performance Curve







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