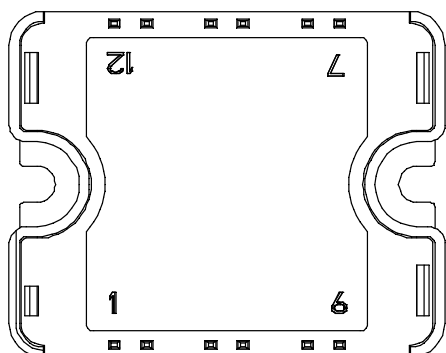
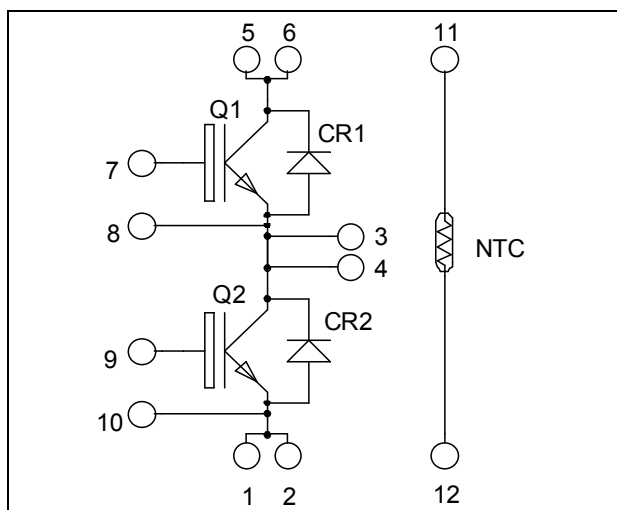


## Phase leg NPT IGBT Power Module

**$V_{CES} = 600V$**   
 **$I_C = 30A @ T_c = 80^\circ C$**



Pins 1/2 ; 3/4 ; 5/6 must be shorted together

### 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 VF
  - Low leakage current
  - RBSOA and SCSOA rated
- Very low stray inductance
  - Symmetrical design
- Internal thermistor for temperature monitoring
- 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
- 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	$T_C = 25^\circ C$	42
		$T_C = 80^\circ C$	30
$I_{CM}$	Pulsed Collector Current	$T_C = 25^\circ C$	100
$V_{GE}$	Gate - Emitter Voltage	$\pm 20$	V
$P_D$	Maximum Power Dissipation	$T_C = 25^\circ C$	140
RBSOA	Reverse Bias Safe Operating Area	$T_j = 125^\circ C$	60A@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	
$V_{CE(on)}$	Collector Emitter on Voltage	$V_{GE} = 15\text{V}$ $I_C = 30\text{A}$	$T_j = 25^\circ\text{C}$	1.7	2.0	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	$V_{GE} = 0\text{V}$		1350		pF
$C_{oes}$	Output Capacitance	$V_{CE} = 25\text{V}$		193		
$C_{res}$	Reverse Transfer Capacitance	$f = 1\text{MHz}$		120		
$Q_g$	Total gate Charge	$V_{GE} = 15\text{V}$		99		nC
$Q_{ge}$	Gate – Emitter Charge	$V_{Bus} = 300\text{V}$		10		
$Q_{gc}$	Gate – Collector Charge	$I_C = 30\text{A}$		60		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching ( $25^\circ\text{C}$ )		30		ns
$T_r$	Rise Time	$V_{GE} = 15\text{V}$		12		
$T_{d(off)}$	Turn-off Delay Time	$V_{Bus} = 400\text{V}$		80		
$T_f$	Fall Time	$I_C = 30\text{A}$ $R_G = 6.8\Omega$		15		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching ( $125^\circ\text{C}$ )		32		ns
$T_r$	Rise Time	$V_{GE} = 15\text{V}$		12		
$T_{d(off)}$	Turn-off Delay Time	$V_{Bus} = 400\text{V}$		90		
$T_f$	Fall Time	$I_C = 30\text{A}$ $R_G = 6.8\Omega$		21		
$E_{on}$	Turn-on Switching Energy	$V_{GE} = 15\text{V}$ $V_{Bus} = 400\text{V}$	$T_j = 125^\circ\text{C}$	0.3		mJ
$E_{off}$	Turn-off Switching Energy	$I_C = 30\text{A}$ $R_G = 6.8\Omega$	$T_j = 125^\circ\text{C}$	0.8		

### Reverse 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	$V_R = 600\text{V}$	$T_j = 25^\circ\text{C}$		25	$\mu\text{A}$
			$T_j = 125^\circ\text{C}$		500	
$I_F$	DC Forward Current		$T_c = 80^\circ\text{C}$	25		A
$V_F$	Diode Forward Voltage	$I_F = 25\text{A}$		1.8	2.2	V
		$I_F = 50\text{A}$		2.2		
		$I_F = 25\text{A}$ $T_j = 125^\circ\text{C}$		1.6		
$t_{rr}$	Reverse Recovery Time	$I_F = 25\text{A}$ $V_R = 400\text{V}$	$T_j = 25^\circ\text{C}$	30		ns
			$T_j = 125^\circ\text{C}$	175		
$Q_{rr}$	Reverse Recovery Charge	$di/dt = 200\text{A}/\mu\text{s}$	$T_j = 25^\circ\text{C}$	55		nC
			$T_j = 125^\circ\text{C}$	485		

**Thermal and package characteristics**

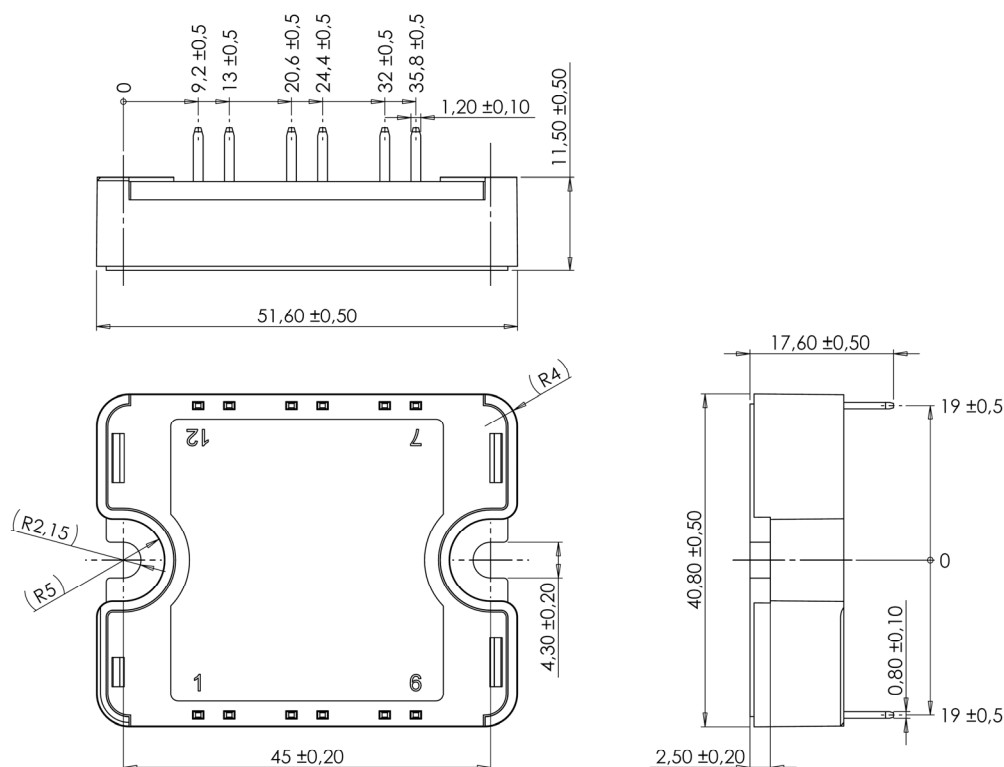
Symbol	Characteristic		Min	Typ	Max	Unit
R <sub>thJC</sub>	Junction to Case Thermal Resistance	IGBT			0.9	°C/W
		Diode			1.4	
V <sub>ISOL</sub>	RMS Isolation Voltage, any terminal to case t=1 min, 50/60Hz		4000			V
T <sub>J</sub>	Operating junction temperature range		-40		150	°C
T <sub>STG</sub>	Storage Temperature Range		-40		125	
T <sub>C</sub>	Operating Case Temperature		-40		100	
Torque	Mounting torque	To heatsink	M4	2	3	N.m
Wt	Package Weight				80	g

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

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

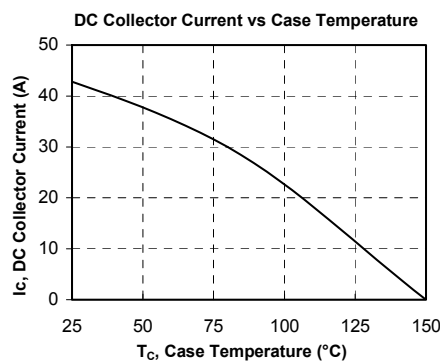
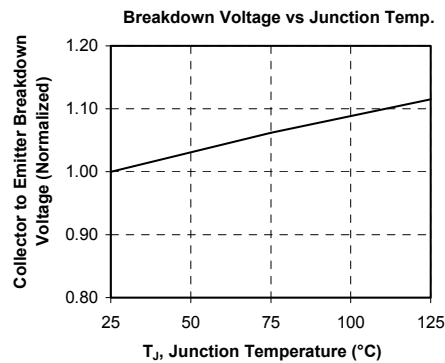
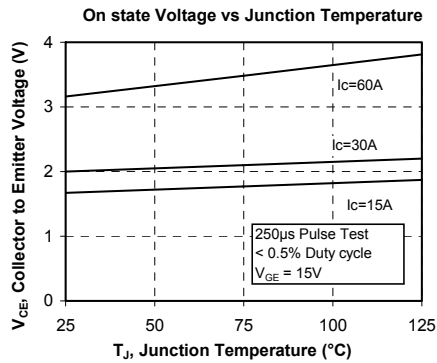
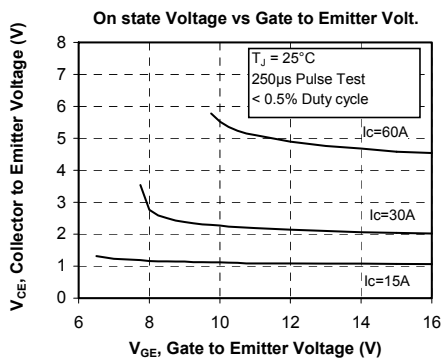
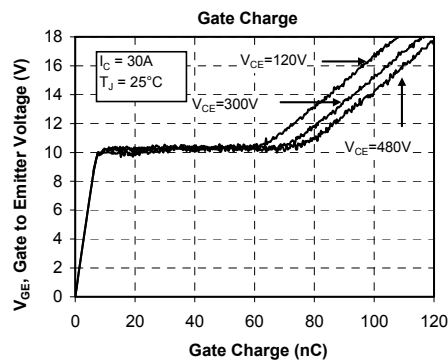
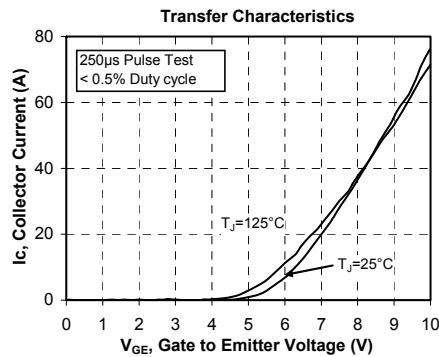
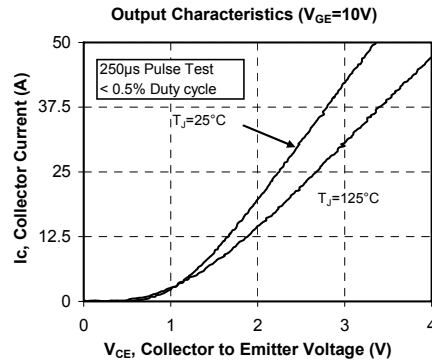
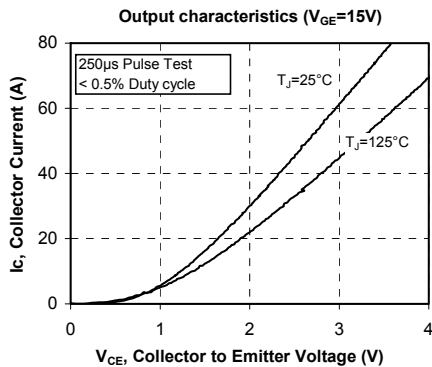
$$R_T = \frac{R_{25}}{\exp \left[ B_{25/85} \left( \frac{1}{T_{25}} - \frac{1}{T} \right) \right]}$$

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

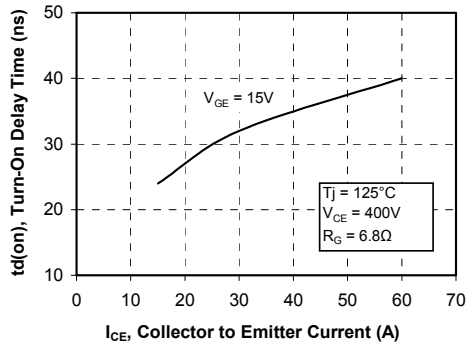
**SP1 Package outline** (dimensions in mm)


See application note 1904 - Mounting Instructions for SP1 Power Modules on [www.microsemi.com](http://www.microsemi.com)

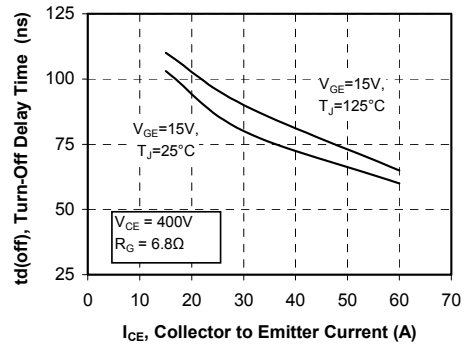
## Typical Performance Curve



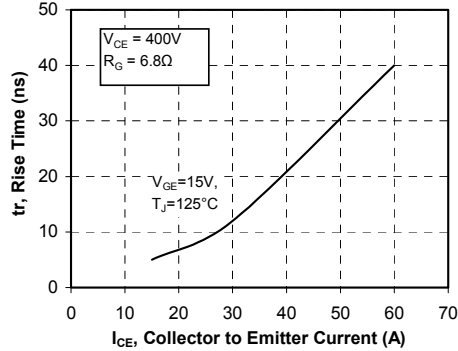
Turn-On Delay Time vs Collector Current



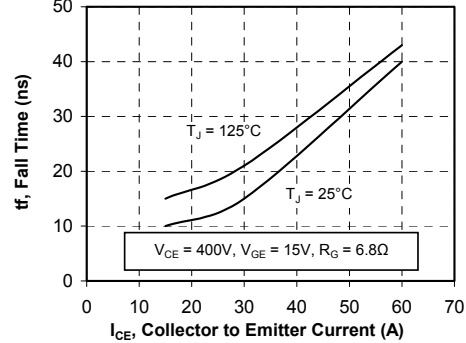
Turn-Off Delay Time vs Collector Current



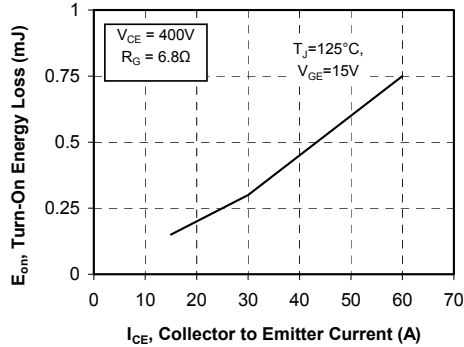
Current Rise Time vs Collector Current



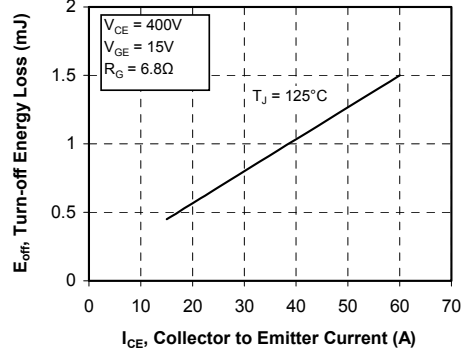
Current Fall Time vs Collector Current



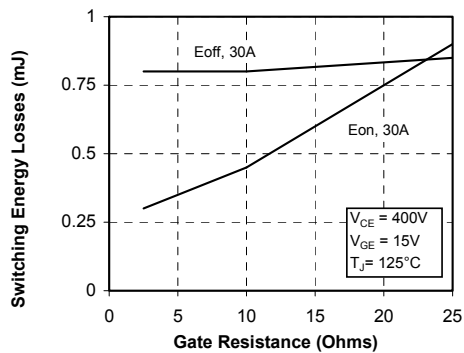
Turn-On Energy Loss vs Collector Current



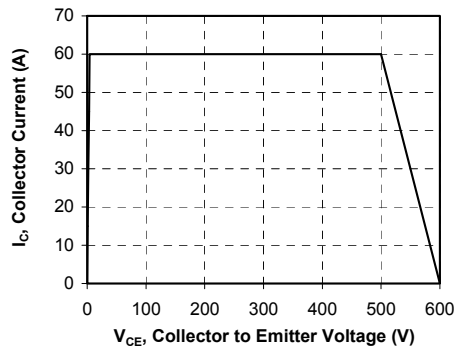
Turn-Off Energy Loss vs Collector Current

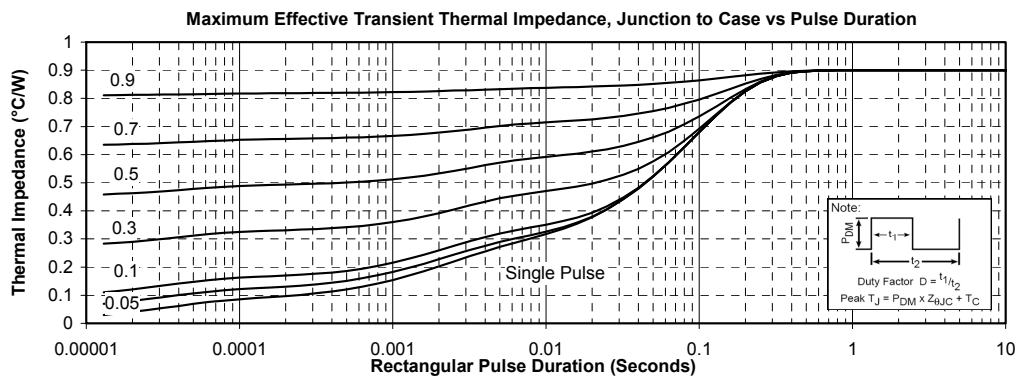
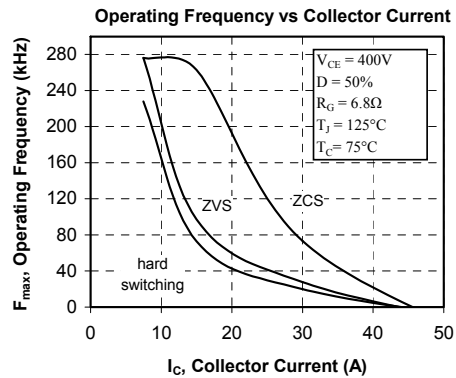
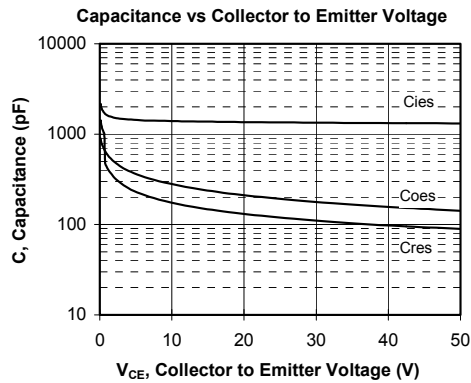


Switching Energy Losses vs Gate Resistance



Reverse Bias Safe Operating Area





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