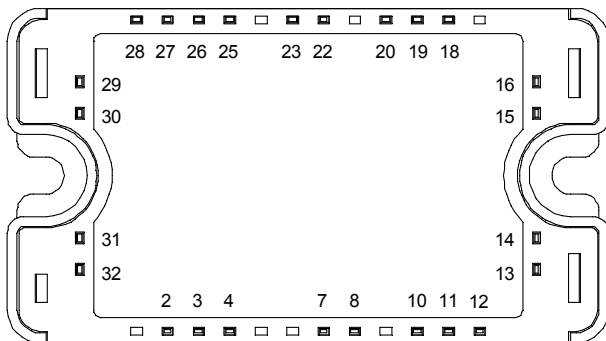
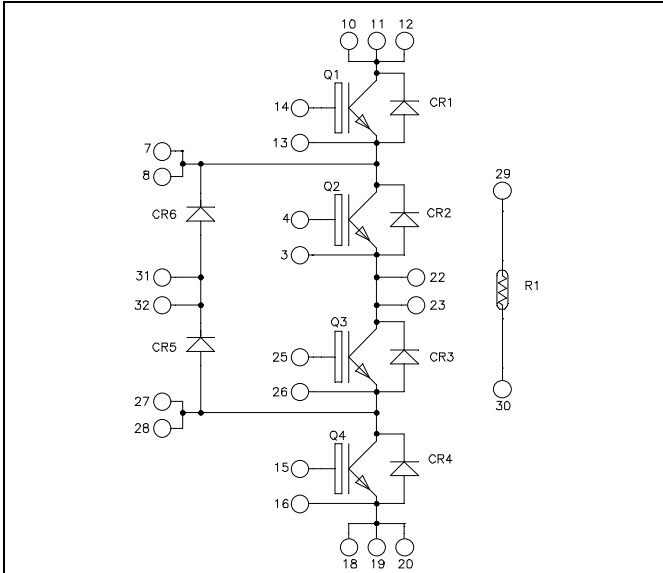


**Three level inverter  
Trench + Field Stop IGBT  
Power Module**

**$V_{CES} = 600V$   
 $I_C = 20A @ T_c = 80^\circ C$**



All multiple inputs and outputs must be shorted together  
 Example: 10/11/12 ; 7/8 ...

### Application

- Solar converter
- Uninterruptible Power Supplies

### Features

- Trench + Field Stop IGBT Technology
  - Low voltage drop
  - Low tail current
  - Switching frequency up to 20 kHz
  - Soft recovery parallel diodes
  - Low diode VF
  - Low leakage current
  - RBSOA and SCSOA rated
- Kelvin emitter for easy drive
- Very low stray inductance
- High level of integration
- Internal thermistor for temperature monitoring

### Benefits

- Stable temperature behavior
- Very rugged
- Direct mounting to heatsink (isolated package)
- Low junction to case thermal resistance
- Easy paralleling due to positive TC of VCEsat
- Low profile
- RoHS Compliant

### Q1 to Q4 Absolute maximum ratings

Symbol	Parameter	Max ratings	Unit
$V_{CES}$	Collector - Emitter Breakdown Voltage	600	V
$I_C$	Continuous Collector Current	$T_c = 25^\circ C$	32
		$T_c = 80^\circ C$	20
$I_{CM}$	Pulsed Collector Current	$T_c = 25^\circ C$	40
$V_{GE}$	Gate - Emitter Voltage	$\pm 20$	V
$P_D$	Maximum Power Dissipation	$T_c = 25^\circ C$	62
RBSOA	Reverse Bias Safe Operating Area	$T_J = 150^\circ C$	40A @ 550V

**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

**Q1 to Q4 Electrical Characteristics**

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
$I_{CES}$	Zero Gate Voltage Collector Current	$V_{GE} = 0V, V_{CE} = 600V$			250	$\mu\text{A}$
$V_{CE(sat)}$	Collector Emitter Saturation Voltage	$V_{GE} = 15V$ $I_C = 20A$	$T_j = 25^\circ\text{C}$	1.5	1.9	V
			$T_j = 150^\circ\text{C}$	1.7		
$V_{GE(th)}$	Gate Threshold Voltage	$V_{GE} = V_{CE}, I_C = 300\mu\text{A}$	5.0	5.8	6.5	V
$I_{GES}$	Gate – Emitter Leakage Current	$V_{GE} = 20V, V_{CE} = 0V$			300	nA

**Q1 to Q4 Dynamic Characteristics**

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
$C_{ies}$	Input Capacitance	$V_{GE} = 0V$		1100		pF
$C_{oes}$	Output Capacitance	$V_{CE} = 25V$		70		
$C_{res}$	Reverse Transfer Capacitance	$f = 1\text{MHz}$		35		
$Q_G$	Gate charge	$V_{GE} = \pm 15V, I_C = 20A$ $V_{CE} = 300V$		0.2		$\mu\text{C}$
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching ( $25^\circ\text{C}$ )		110		ns
$T_r$	Rise Time	$V_{GE} = \pm 15V$ $V_{Bus} = 300V$		45		
$T_{d(off)}$	Turn-off Delay Time	$I_C = 20A$		200		
$T_f$	Fall Time	$R_G = 12\Omega$		40		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching ( $150^\circ\text{C}$ )		120		ns
$T_r$	Rise Time	$V_{GE} = \pm 15V$ $V_{Bus} = 300V$		50		
$T_{d(off)}$	Turn-off Delay Time	$I_C = 20A$		250		
$T_f$	Fall Time	$R_G = 12\Omega$		60		
$E_{on}$	Turn-on Switching Energy	$V_{GE} = \pm 15V$ $V_{Bus} = 300V$	$T_j = 25^\circ\text{C}$	0.11		mJ
			$T_j = 150^\circ\text{C}$	0.2		
$E_{off}$	Turn-off Switching Energy	$I_C = 20A$ $R_G = 12\Omega$	$T_j = 25^\circ\text{C}$	0.5		mJ
			$T_j = 150^\circ\text{C}$	0.7		
$I_{sc}$	Short Circuit data	$V_{GE} \leq 15V; V_{Bus} = 360V$ $t_p \leq 6\mu\text{s}; T_j = 150^\circ\text{C}$		100		A
$R_{thJC}$	Junction to Case Thermal Resistance				2.4	$^\circ\text{C/W}$

**CR1 to CR6 diode ratings and characteristics**

<i>Symbol</i>	<i>Characteristic</i>	<i>Test Conditions</i>		<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Unit</i>
V <sub>RRM</sub>	Maximum Peak Repetitive Reverse Voltage			600			V
I <sub>RM</sub>	Maximum Reverse Leakage Current	V <sub>R</sub> =600V	T <sub>j</sub> = 25°C T <sub>j</sub> = 150°C			150 350	μA
I <sub>F</sub>	DC Forward Current		T <sub>c</sub> = 80°C		20		A
V <sub>F</sub>	Diode Forward Voltage	I <sub>F</sub> = 20A V <sub>GE</sub> = 0V	T <sub>j</sub> = 25°C T <sub>j</sub> = 150°C		1.6 1.5	2	V
t <sub>rr</sub>	Reverse Recovery Time		T <sub>j</sub> = 25°C T <sub>j</sub> = 150°C		100 150		ns
Q <sub>rr</sub>	Reverse Recovery Charge	I <sub>F</sub> = 20A V <sub>R</sub> = 300V di/dt = 1600A/μs	T <sub>j</sub> = 25°C T <sub>j</sub> = 150°C		1.1 2.3		μC
E <sub>rr</sub>	Reverse Recovery Energy		T <sub>j</sub> = 25°C T <sub>j</sub> = 150°C		0.23 0.50		mJ
R <sub>thJC</sub>	Junction to Case Thermal Resistance					3.25	°C/W

**Temperature sensor NTC** (see application note APT0406 on www.microsemi.com for more information).

<i>Symbol</i>	<i>Characteristic</i>	<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Unit</i>
R <sub>25</sub>	Resistance @ 25°C		50		kΩ
ΔR <sub>25</sub> /R <sub>25</sub>			5		%
B <sub>25/85</sub>	T <sub>25</sub> = 298.15 K		3952		K
ΔB/B		T <sub>C</sub> =100°C	4		%

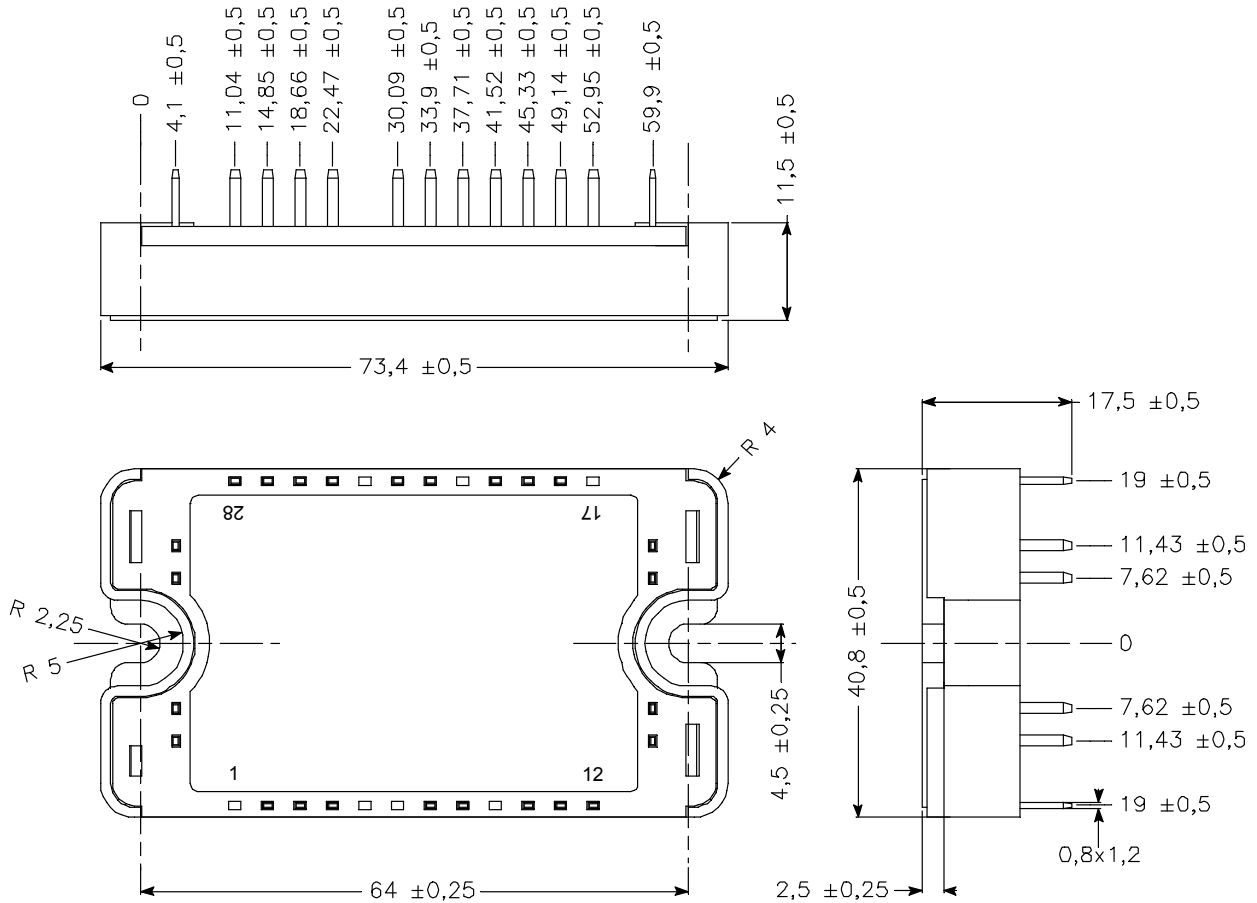
$$R_T = \frac{R_{25}}{\exp\left[B_{25/85}\left(\frac{1}{T_{25}} - \frac{1}{T}\right)\right]}$$

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

**Thermal and package characteristics**

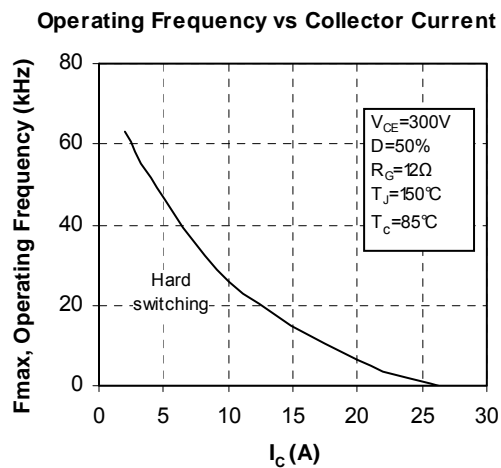
<i>Symbol</i>	<i>Characteristic</i>	<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Unit</i>	
V <sub>ISOL</sub>	RMS Isolation Voltage, any terminal to case t=1 min, I <sub>isol</sub> <1mA, 50/60Hz	2500			V	
T <sub>J</sub>	Operating junction temperature range	-40		175	°C	
T <sub>STG</sub>	Storage Temperature Range	-40		125		
T <sub>C</sub>	Operating Case Temperature	-40		100		
Torque	Mounting torque	To heatsink	M4	2.5	4.7	N.m
Wt	Package Weight				110	g

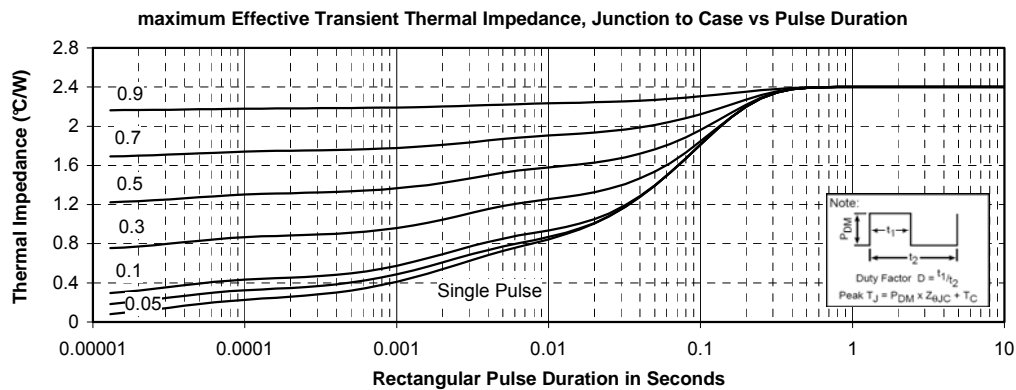
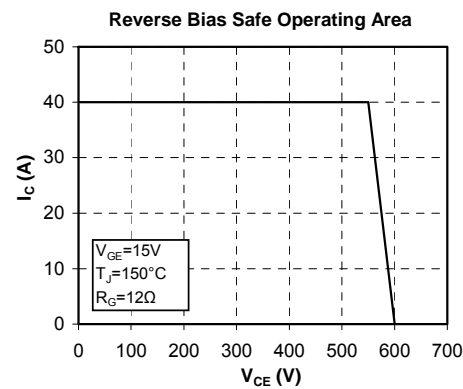
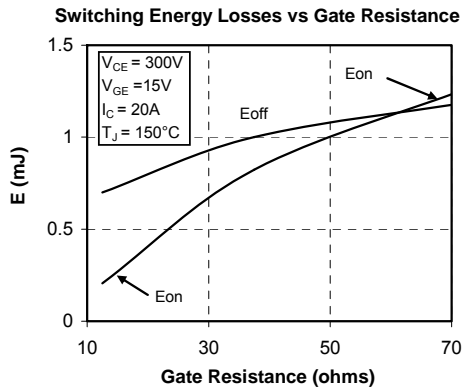
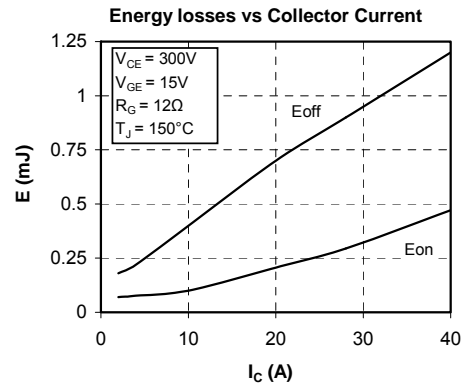
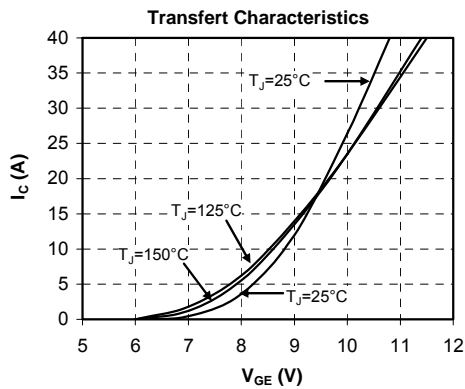
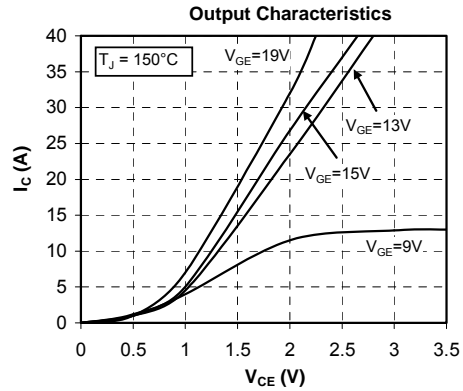
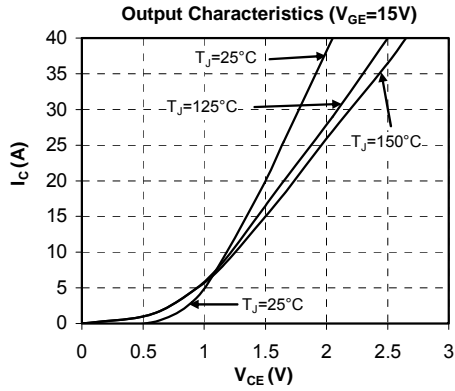
## SP3 Package outline (dimensions in mm)



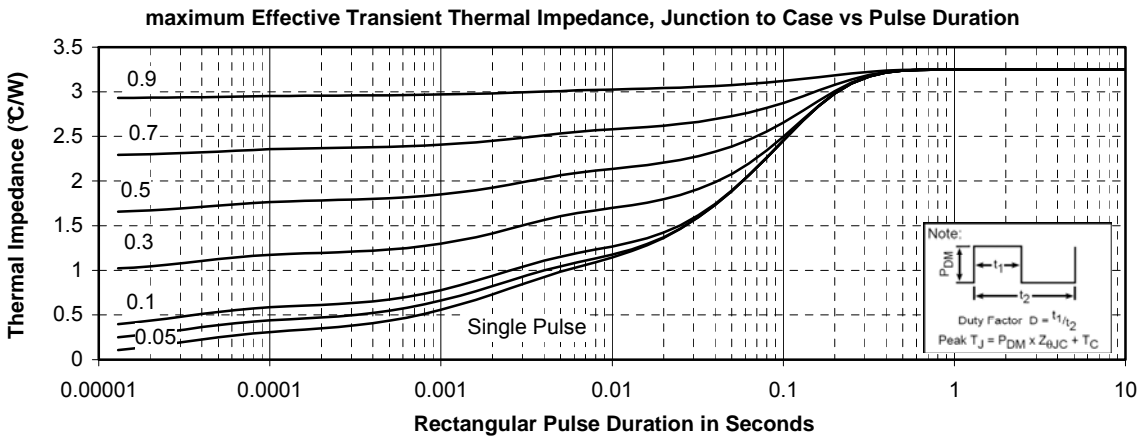
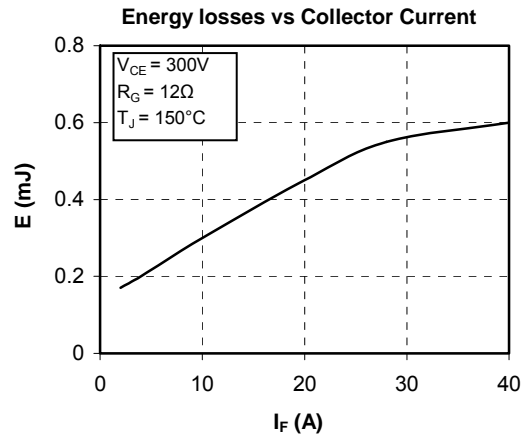
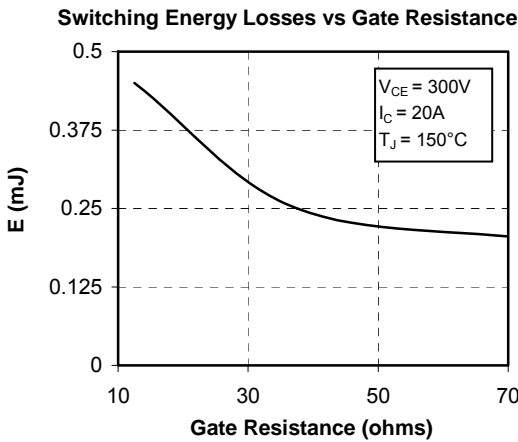
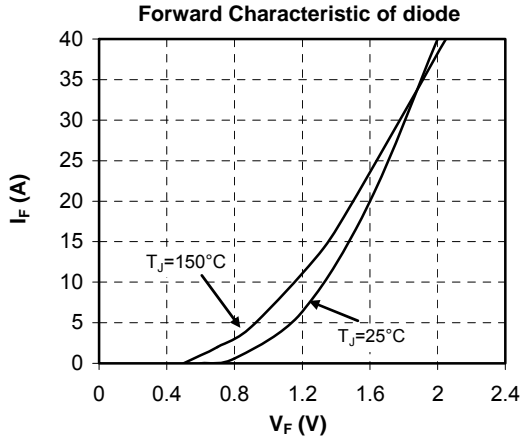
See application note 1901 - Mounting Instructions for SP3 Power Modules on [www.microsemi.com](http://www.microsemi.com)

## Q1 to Q4 Typical performance curve





## CR1 to CR6 Typical performance curve



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