

Features

- High Speed Smooth Switching Device for Hard and Soft Switching
- $V_{ce(sat)}$ with Positive Temperature Coefficient
- High Ruggedness, Good Thermal Stability
- Very Tight Parameter Distribution
- Halogen Free. "Green" Device (Note 1)
- Epoxy Meets UL 94 V-0 Flammability Rating
- Lead Free Finish/RoHS Compliant ("P" Suffix Designates RoHS Compliant. See Ordering Information)

Maximum Ratings

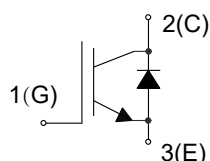
- Operating Junction Temperature Range : -40°C to $+175^{\circ}\text{C}$
- Storage Temperature Range: -55°C to $+150^{\circ}\text{C}$
- IGBT Thermal Resistance: 0.46°C/W Junction to Case
- Diode Thermal Resistance: 0.51°C/W Junction to Case
- Thermal Resistance: 40°C/W Junction to Ambient

Parameter	Symbol	Rating	Unit
Collector-Emitter Voltage	V_{CE}	650	V
DC Collector Current ⁽²⁾	I_C	$T_C=25^{\circ}\text{C}$	75
		$T_C=100^{\circ}\text{C}$	50
Pulsed Collector Current ⁽³⁾	$I_{C,pluse}$	200	A
Diode Forward Current ⁽²⁾	I_F	$T_C=25^{\circ}\text{C}$	75
		$T_C=100^{\circ}\text{C}$	50
Diode Pulsed Current ⁽³⁾	$I_{F,pluse}$	200	A
Gate-Emitter Voltage	V_{GE}	± 20	V
Transient Gate-Emitter Voltage ⁽⁴⁾		± 30	
Short Circuit Withstand Time ⁽⁵⁾ $V_{GE}=15\text{V}, V_{CC}=600\text{V}, T_J \leq 150^{\circ}\text{C}$	t_{SC}	5	μs
Power Dissipation	P_D	$T_C=25^{\circ}\text{C}$	326
		$T_C=100^{\circ}\text{C}$	163

Note:

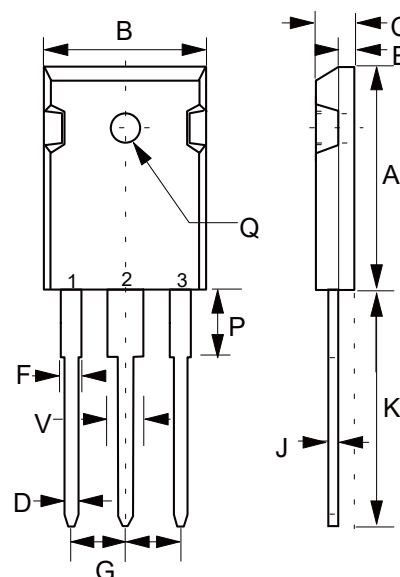
1. Halogen free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
2. Limited by T_{Jmax} .
3. T_p limited by T_{Jmax} .
4. $T_p \leq 10\mu\text{s}$, Duty Cycle < 1%
5. Allowed number of short circuits: < 1000; time between short circuits: > 1s.

Internal Structure



Trench and Field Stop IGBT 650V 50A

TO-247



DIM	DIMENSIONS				NOTE
	INCHES		MM		
	MIN	MAX	MIN	MAX	
A	0.787	0.866	20.00	22.00	
B	0.598	0.638	15.20	16.20	
C	0.185	0.208	4.70	5.30	
D	0.035	0.059	0.90	1.50	
E	0.059	0.094	1.50	2.40	
F	0.067	0.091	1.70	2.30	
J	0.019	0.031	0.48	0.80	
K	0.748	0.833	19.00	21.15	
P	0.122	0.189	3.10	4.80	
Q	0.118	0.150	3.00	3.80	Φ
V	0.106	0.134	2.70	3.40	
G	0.197	0.224	5.00	5.70	

Electrical Characteristics @ 25°C (Unless Otherwise Specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Static Characteristics						
Collector-Emitter Breakdown Voltage	$V_{(BR)CES}$	$V_{GE}=0V, I_C=250\mu A$	650			V
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$V_{GE}=15V, I_C=50A, T_J=25^\circ C$		1.58	2.1	V
		$V_{GE}=15V, I_C=50A, T_J=125^\circ C$		1.87		
		$V_{GE}=15V, I_C=50A, T_J=150^\circ C$		1.95		
G-E Threshold Voltage	$V_{GE(th)}$	$I_C=250\mu A, V_{CE}=V_{GE}$	4.2	5.0	5.8	V
C-E Leakage Current	I_{CES}	$V_{CE}=650V, V_{GE}=0V$			1	mA
G-E Leakage Current	I_{GES}	$V_{CE}=0V, V_{GE}=\pm 20V$			200	nA
Dynamic Characteristics						
Input Capacitance	C_{ies}	$V_{CE}=25V, V_{GE}=0V, f=1MHz$		5.46		nF
Reverse Transfer Capacitance	C_{res}			0.1		
Gate Charge	Q_g	$V_{CC}=300V, I_C=50A, V_{GE}=15V$		0.13		uC
IGBT Switching Characteristics						
Turn-On Delay Time	$t_{d(on)}$	$V_{CC}=400V, I_C=50A, V_{GE}=-15/15V, R_G=8\Omega, L_S=60nH, T_J=25^\circ C$		43		ns
Rise Time	t_r			75		
Turn-Off Delay Time	$t_{d(off)}$			153		
Fall Time	t_f			57		
Turn-On Energy	E_{on}	$V_{CC}=400V, I_C=50A, V_{GE}=-15/15V, R_G=8\Omega, L_S=60nH, T_J=25^\circ C$		1.86		mJ
Turn-Off Energy	E_{off}			0.64		
Turn-On Delay Time	$t_{d(on)}$			20		
Rise Time	t_r			67		
Turn-Off Delay Time	$t_{d(off)}$	$V_{CC}=400V, I_C=50A, V_{GE}=-15/15V, R_G=8\Omega, L_S=60nH, T_J=125^\circ C$		141		ns
Fall Time	t_f			65		
Turn-On Energy	E_{on}			1.86		
Turn-Off Energy	E_{off}			0.67		
Turn-On Delay Time	$t_{d(on)}$	$V_{CC}=400V, I_C=50A, V_{GE}=-15/15V, R_G=8\Omega, L_S=60nH, T_J=150^\circ C$		19		ns
Rise Time	t_r			65		
Turn-Off Delay Time	$t_{d(off)}$			145		
Fall Time	t_f			66		
Turn-On Energy	E_{on}	$V_{CC}=400V, I_C=50A, V_{GE}=-15/15V, R_G=8\Omega, L_S=60nH, T_J=150^\circ C$		1.86		mJ
Turn-Off Energy	E_{off}			0.71		

Electrical Characteristics @ 25°C (Unless Otherwise Specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Diode Characteristics						
Diode Forward Voltage	V_F	$V_{GE}=0V, I_F=50A, T_J=25^\circ C$		1.33	1.9	V
		$V_{GE}=0V, I_F=50A, T_J=125^\circ C$		1.2		
		$V_{GE}=0V, I_F=50A, T_J=150^\circ C$		1.17		
Reverse Recovery Current	I_{rr}	$V_R=400V, I_F=50A,$ $di_F/dt=-387A/\mu s, T_J=25^\circ C$		26		A
Reverse Recovery Charge	Q_{rr}			2.12		μC
Reverse Recovery Energy	E_{rec}			0.65		mJ
Reverse Recovery Current	I_{rr}	$V_R=400V, I_F=50A,$ $di_F/dt=-387A/\mu s, T_J=125^\circ C$		37		A
Reverse Recovery Charge	Q_{rr}			4.65		μC
Reverse Recovery Energy	E_{rec}			0.88		mJ
Reverse Recovery Current	I_{rr}	$V_R=400V, I_F=50A,$ $di_F/dt=-387A/\mu s, T_J=150^\circ C$		42		A
Reverse Recovery Charge	Q_{rr}			5.66		μC
Reverse Recovery Energy	E_{rec}			0.95		mJ

Curve Characteristics

Fig. 1 - Typical Output Characteristics
($V_{GE}=15V$)

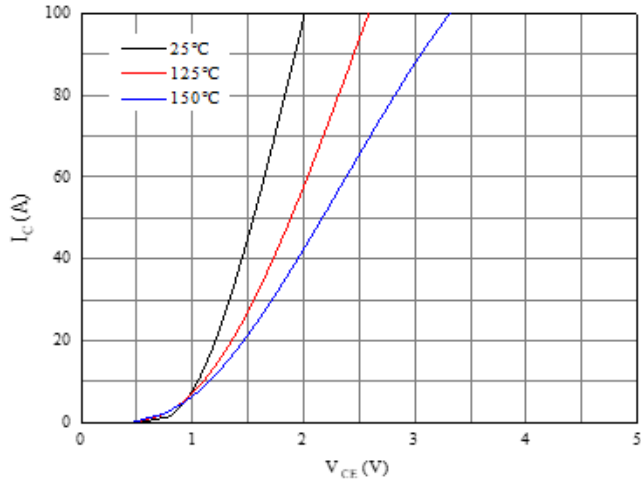


Fig. 2 - Typical Output Characteristics
($T_J=150^\circ C$)

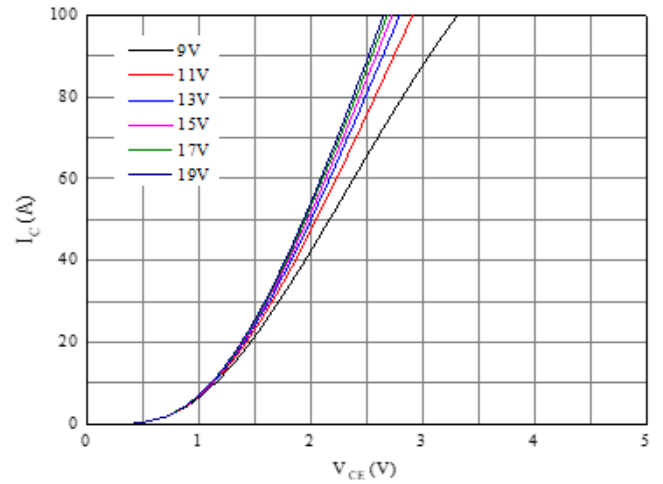


Fig. 3 - Typical transfer Characteristic
($V_{CE}=20V$)

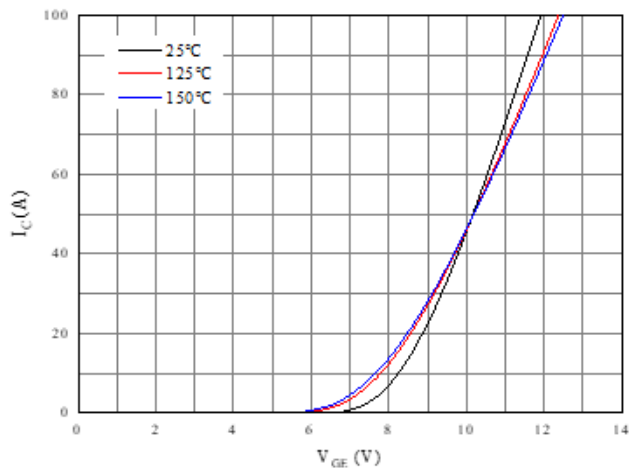


Fig. 4 - Forward Characteristic of Diode

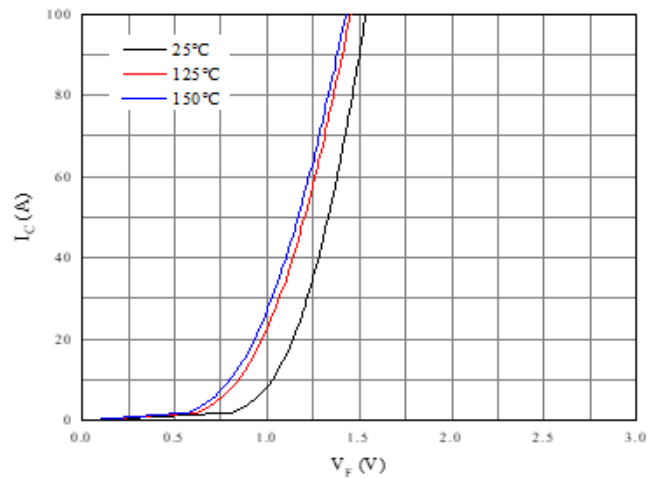


Fig. 5 - Switching Losses of IGBT
($V_{GE}=\pm 15V$, $R_{Gon}=8\Omega$, $R_{Goff}=8\Omega$, $V_{CE}=400V$)

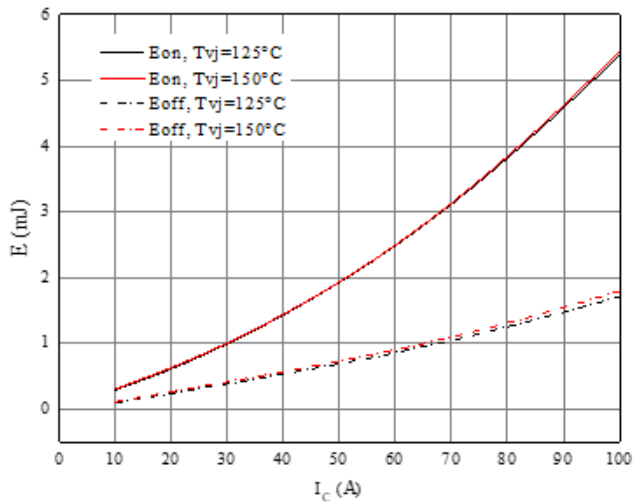
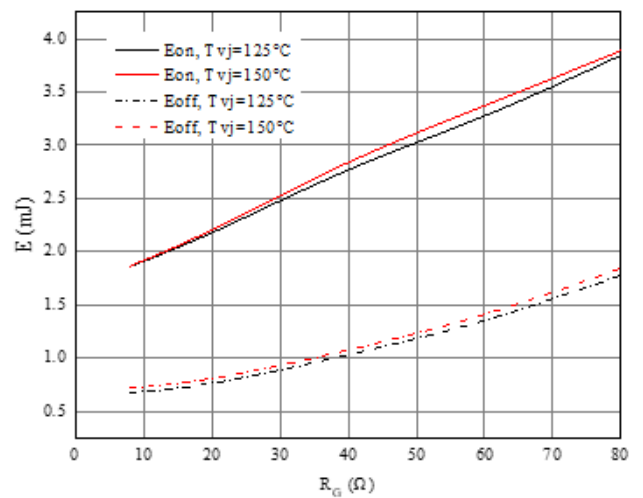


Fig. 6 - Switching Losses of IGBT
($V_{GE}=\pm 15V$, $I_C=50A$, $V_{CE}=400V$)



Curve Characteristics

Fig. 7 - Switching Losses of Diode
($R_{Gon}=8\Omega$, $V_{CE}=400V$)

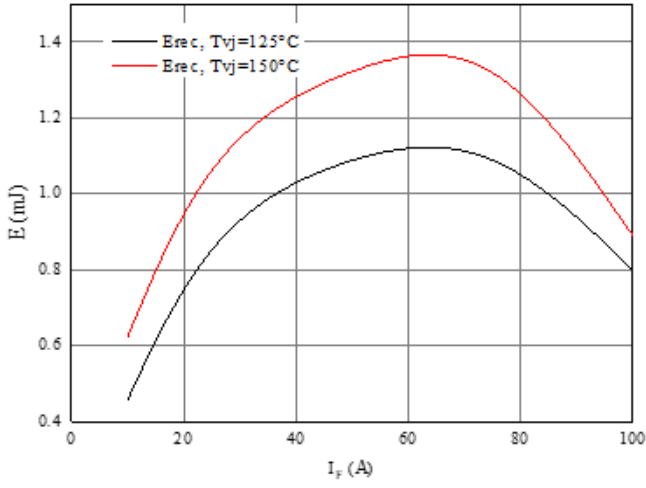


Fig. 8 - Switching Losses of Diode
($I_F=50A$, $V_{CE}=400V$)

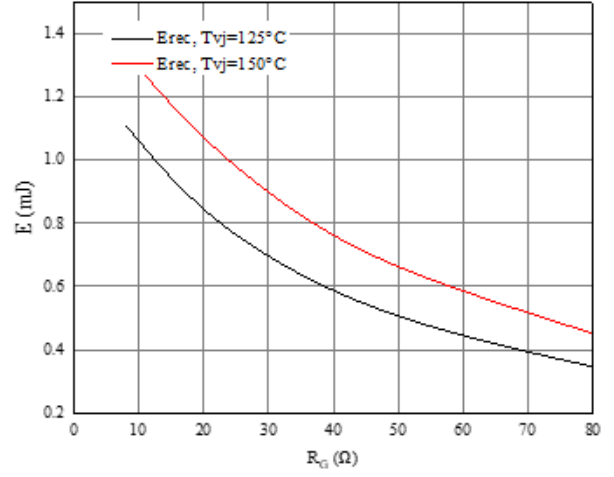
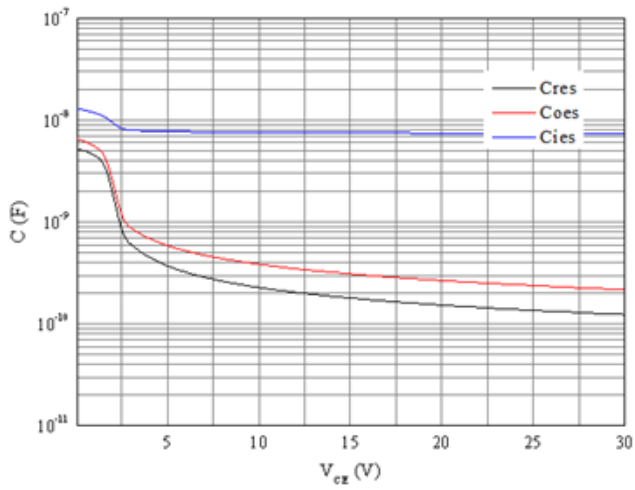


Fig. 9 - Capacitance Characteristics



Ordering Information

Device	Packing
Part Number-BP	Tube: 30pcs/Tube, 1800pcs/Ctn

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