

Features

- Low $V_{ce(sat)}$, Fast Switching
- $V_{ce(sat)}$ with Positive Temperature Coefficient
- High Ruggedness, Good Thermal Stability
- Very Tight Parameter Distribution
- Epoxy Meets UL 94 V-0 Flammability Rating
- Lead Free Finish/RoHS Compliant ("P" Suffix Designates RoHS Compliant. See Ordering Information)

Maximum Ratings

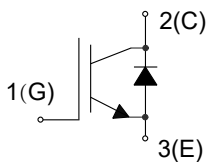
- Operating Junction Temperature Range : -55°C to +175°C
- Storage Temperature Range: -55°C to +175°C
- IGBT Thermal Resistance: 0.6°C/W Junction to Case
- Diode Thermal Resistance: 0.65°C/W Junction to Case
- Thermal Resistance: 40°C/W Junction to Ambient

Parameter	Symbol	Rating	Unit
Collector-Emitter Voltage	V_{CE}	650	V
DC Collector Current ⁽¹⁾	I_C	$T_C=25^\circ\text{C}$	80
		$T_C=100^\circ\text{C}$	50
Pulsed Collector Current ⁽²⁾	$I_{C,pluse}$	200	A
Diode Forward Current ⁽¹⁾	I_F	$T_C=25^\circ\text{C}$	40
		$T_C=100^\circ\text{C}$	20
Diode Pulsed Current ⁽²⁾	$I_{F,pluse}$	150	A
Gate-Emitter Voltage	V_{GE}	± 20	V
Power Dissipation	P_D	$T_C=25^\circ\text{C}$	250
		$T_C=100^\circ\text{C}$	100

Note:

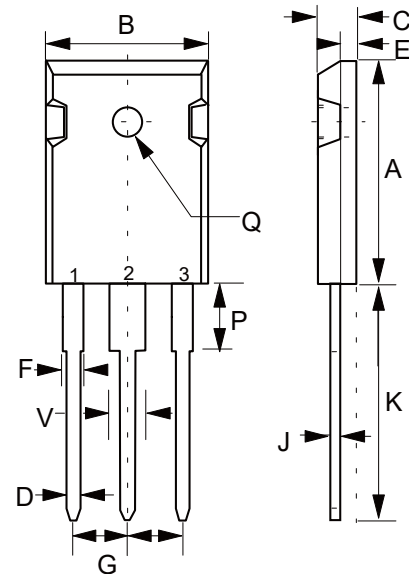
1. Limited by T_{Jmax} .
2. T_p limited by T_{Jmax} .

Internal Structure



Trench and Field Stop IGBT 650V 50A

TO-247



DIM	INCHES		MM		NOTE
	MIN	MAX	MIN	MAX	
A	0.815	0.839	20.70	21.30	
B	0.610	0.634	15.50	16.10	
C	0.189	0.205	4.80	5.20	
D	0.043	0.055	1.10	1.40	
E	0.071	0.087	1.80	2.20	
F	0.075	0.089	1.90	2.25	
J	0.020	0.030	0.50	0.75	
K	0.772	0.799	19.60	20.30	
P	0.122	0.169	3.10	4.30	
Q	0.134	0.150	3.40	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	$V_{(BR)CES}$	$V_{GE}=0V, I_C=0.25mA$	650			V
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$V_{GE}=15V, I_C=50A$		1.5	1.9	V
		$V_{GE}=15V, I_C=50A, T_J=125^\circ C$		1.85		V
		$V_{GE}=15V, I_C=50A, T_J=150^\circ C$		1.95		V
Diode Forward Voltage	V_F	$V_{GE}=0V, I_F=20A$		1.5	1.9	V
		$V_{GE}=0V, I_F=20A, T_J=125^\circ C$		1.4		V
		$V_{GE}=0V, I_F=20A, T_J=150^\circ C$		1.35		V
G-E Threshold Voltage	$V_{GE(th)}$	$I_C=1mA, V_{CE}=V_{GE}$	4.5	5.5	6.5	V
C-E Leakage Current	I_{CES}	$V_{CE}=650V, V_{GE}=0V$			0.01	mA
		$V_{CE}=650V, V_{GE}=0V, T_J=150^\circ C$			1	
G-E Leakage Current	I_{GES}	$V_{CE}=0V, V_{GE}=20V$			250	nA
Transconductance	g_{FS}	$V_{CE}=20V, I_C=50A$		21		S
Dynamic Characteristics						
Input Capacitance	C_{iss}	$V_{CE}=25V, V_{GE}=0V, f=1MHz$		4579		pF
Output Capacitance	C_{oss}			192		
Reverse Transfer Capacitance	C_{rss}			58		
Gate Charge	Q_g	$V_{CC}=300V, I_C=50A, V_{GE}=15V$		186		nC

Electrical Characteristics @ 25°C (Unless Otherwise Specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
IGBT Switching Characteristics						
Turn-On Delay Time	$t_{d(on)}$	$V_{CC}=400V, I_C=50A,$ $V_{GE}=0/15V, R_G=10\Omega,$ Inductive load		69		ns
Rise Time	t_r			45		
Turn-Off Delay Time	$t_{d(off)}$			404		
Fall Time	t_f			58		
Turn-On Energy	E_{on}			1.59		mJ
Turn-Off Energy	E_{off}			1.34		
Total Switching Energy	E_{ts}		2.93			
Turn-On Delay Time	$t_{d(on)}$	$V_{CC}=400V, I_C=50A,$ $V_{GE}=0/15V, R_G=10\Omega, T_J=125^\circ C$ Inductive load		66		ns
Rise Time	t_r			42		
Turn-Off Delay Time	$t_{d(off)}$			414		
Fall Time	t_f			71		
Turn-On Energy	E_{on}			2.01		mJ
Turn-Off Energy	E_{off}			1.67		
Total Switching Energy	E_{ts}		3.68			
Diode Characteristics						
Reverse Recovery Time	t_{rr}	$V_R=400V, I_F=20A,$ $di_F/dt=220A/\mu s$		88		ns
Reverse Recovery Charge	Q_{rr}			0.24		μC
Peak Reverse Recovery Current	I_{rrm}			6		A
Reverse Recovery Time	t_{rr}	$V_R=400V, I_F=20A,$ $di_F/dt=220A/\mu s, T_J=125^\circ C$		230		ns
Reverse Recovery Charge	Q_{rr}			1.05		μC
Peak Reverse Recovery Current	I_{rrm}			10		A

Curve Characteristics

Fig. 1 - Typical Output Characteristics

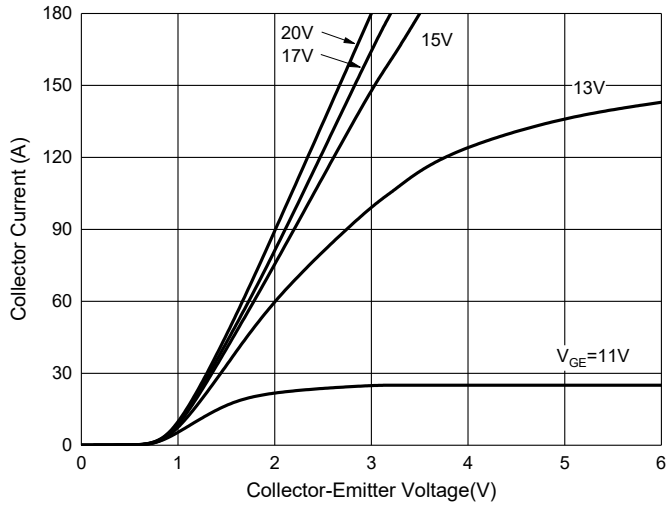


Fig. 2 - Transfer Characteristics

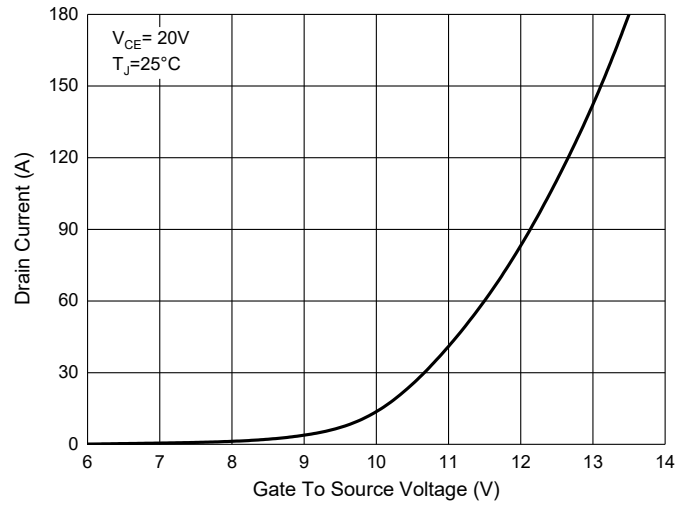


Fig. 3 - Capacitance Characteristics

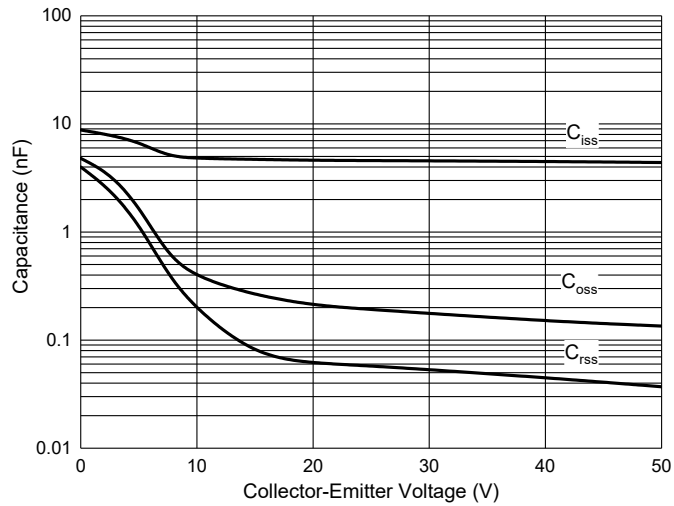


Fig. 4 - Gate Charge

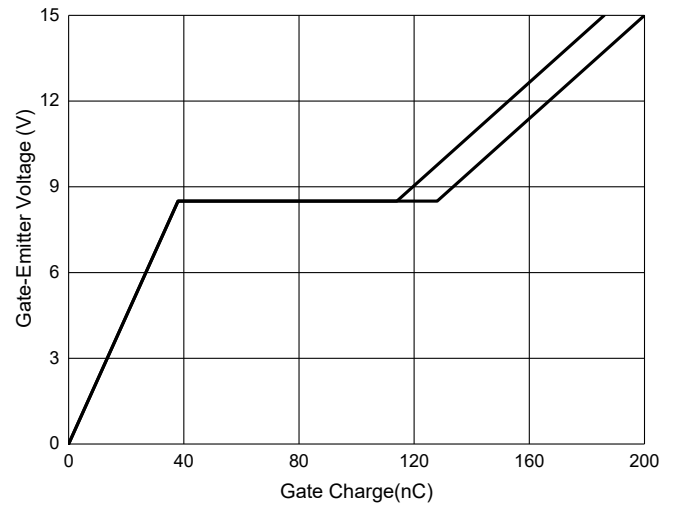


Fig. 5 - Power Derating Curve

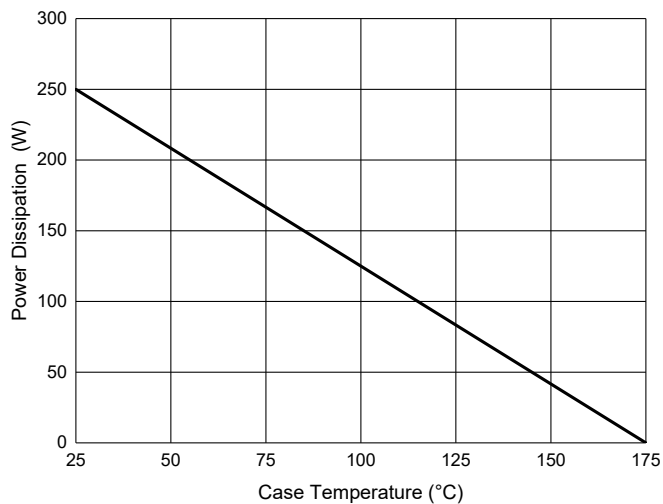
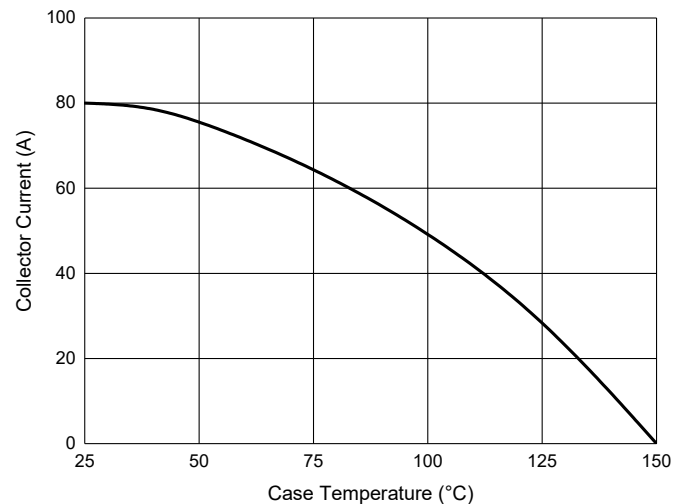


Fig. 6 - Collector Current Derating Curve



Curve Characteristics

Fig. 7 - $V_{CE(sat)} - T_J$

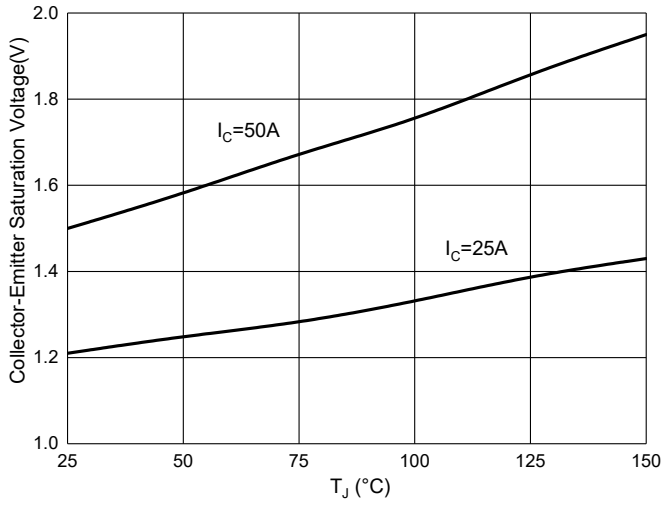


Fig. 8 - $V_{GE(th)} - T_J$

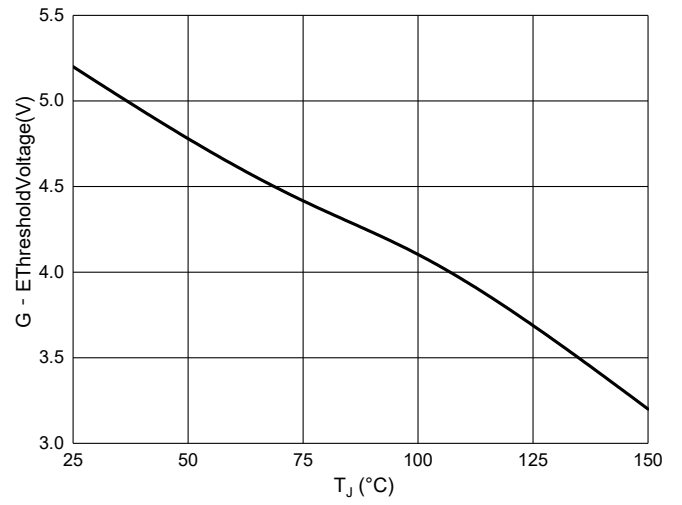


Fig. 9 - $BV_{CES} - T_J$

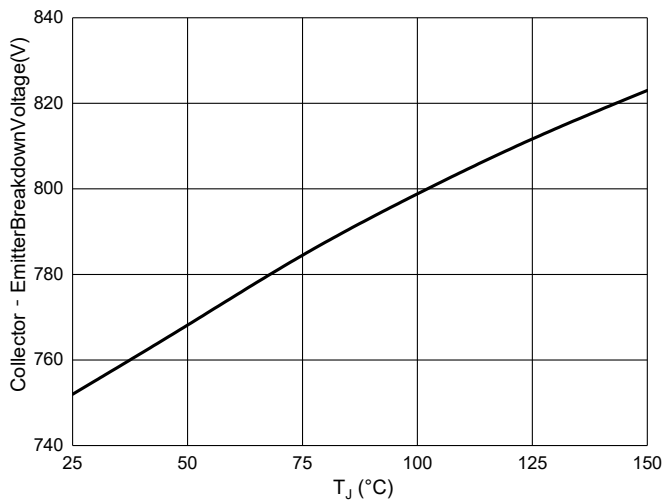


Fig. 10 - $I_{CES} - T_J$

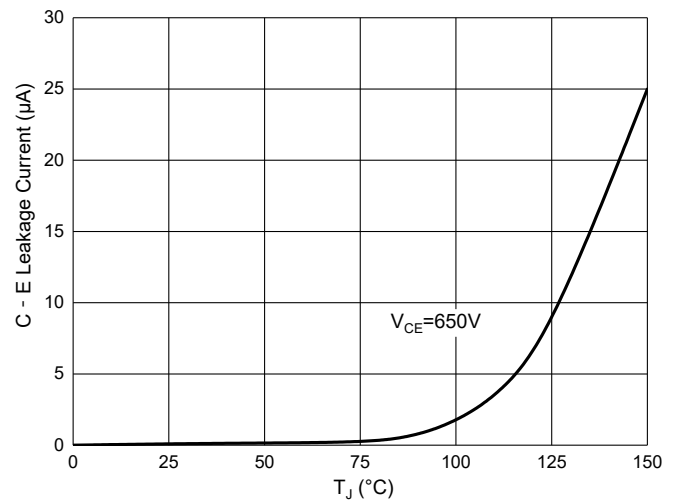


Fig. 11 - Switching Energy Losses - I_C

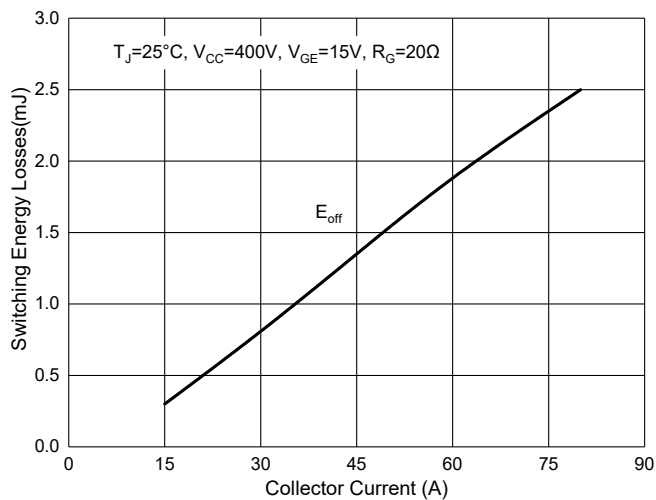
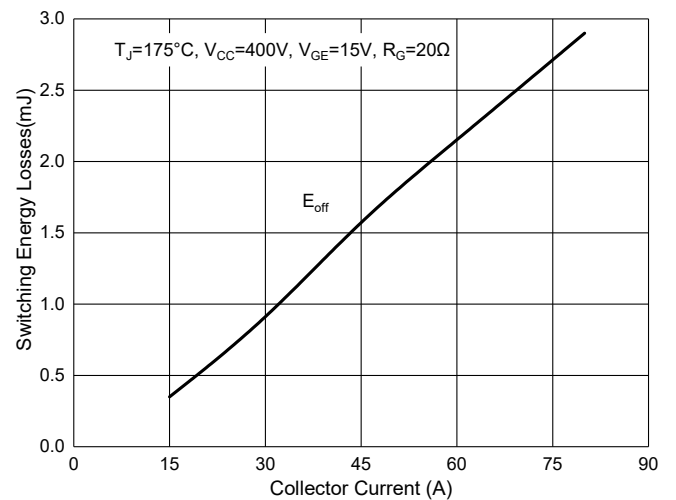


Fig. 12 - Switching Energy Losses - I_C



Curve Characteristics

Fig. 13 - Switching Energy Losses — V_{CE}

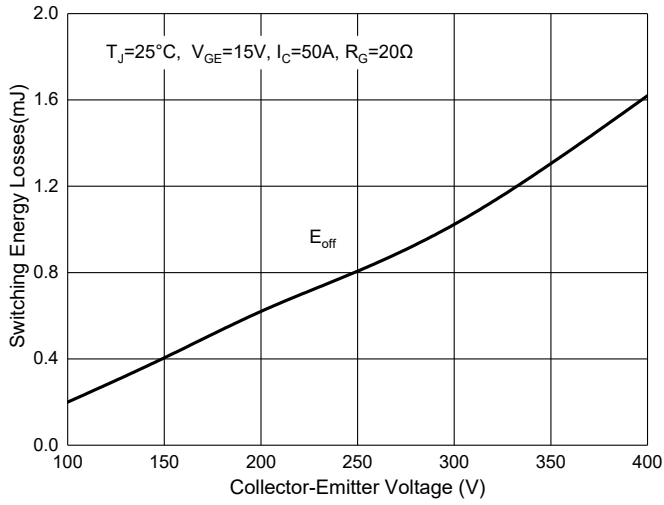


Fig. 14 - Switching Energy Losses — V_{CE}

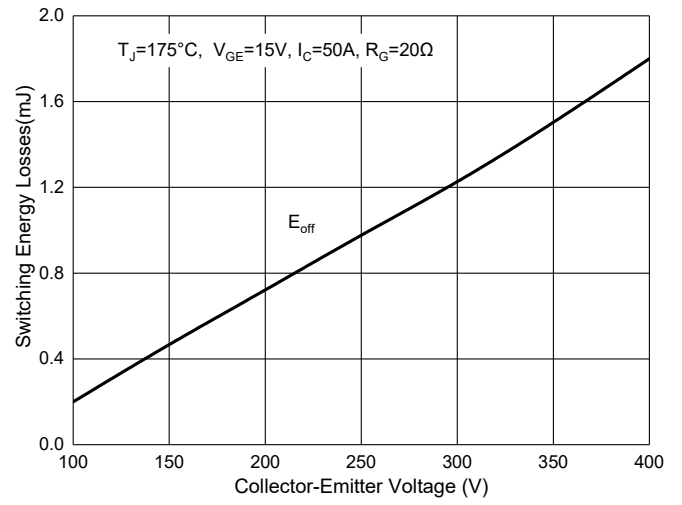
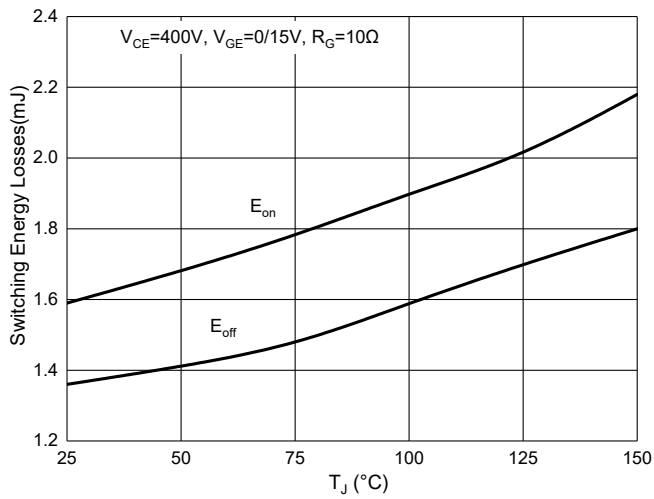


Fig. 15 - Switching Energy Losses — T_J



Ordering Information

Device	Packing
Part Number-BP	Bulk: 360pcs/Box

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