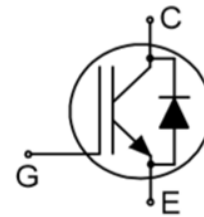


Trench Field-Stop Technology IGBT

Features

- 1200V, 25A
- $V_{CE(sat)(typ.)}=2.00V@V_{GE}=15V, I_C=25A$
- Low Switching Losses
- $V_{CE(sat)}$ with Positive Temperature Coefficient
- Pb-free Lead Plating; RoHS Compliant



Applications

- Frequency Converters
- Uninterrupted Power Supply
- Air Conditioning
- Motor Drives



Absolute Maximum Ratings

Symbol	Parameter	Value	Unit
V_{CES}	Collector-Emitter Voltage	1200	V
V_{GES}	Gate-Emitter Voltage	± 20	V
I_C	Continuous Collector Current ($T_C=25^\circ C$)	50	A
	Continuous Collector Current ($T_C=100^\circ C$)	25	A
I_{CM}	Pulsed Collector Current (Note 1)	100	A
I_F	Diode Continuous Forward Current ($T_C=100^\circ C$)	25	A
I_{FM}	Diode Maximum Forward Current (Note 1)	100	A
t_{sc}	Short Circuit Withstand Time	10	us
P_D	Maximum Power Dissipation ($T_C=25^\circ C$)	365	W
	Maximum Power Dissipation ($T_C=100^\circ C$)	183	W
T_J	Operating Junction Temperature Range	-40 to 175	$^\circ C$
T_{STG}	Storage Temperature Range	-55 to 150	$^\circ C$

Thermal Data

Symbol	Parameter	Max.	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case for IGBT	0.41	$^\circ C/W$
$R_{\theta JC}$	Thermal Resistance, Junction to Case for Diode	0.67	$^\circ C/W$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	40	$^\circ C/W$

IGBT Characteristics ($T_c=25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit	
BV_{CES}	Collector-Emitter Breakdown Voltage	$V_{GE}=0V, I_C=500\mu A$	1200	---	---	V	
I_{CES}	Collector-Emitter Leakage Current	$V_{CE}=1200V, V_{GE}=0V$	---	---	1	mA	
I_{GES}	Gate Leakage Current, Forward	$V_{GE}=20V, V_{CE}=0V$	---	---	400	nA	
	Gate Leakage Current, Reverse	$V_{GE}=-20V, V_{CE}=0V$	---	---	-400	nA	
$V_{GE(th)}$	Gate Threshold Voltage	$V_{GE}=V_{CE}, I_C=480\mu A$	5.2	5.8	6.4	V	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$V_{GE}=15V, I_C=25A$	---	2.00	2.25	V	
Q_G	Total Gate Charge	$V_{CC}=960V$	---	117	---	nC	
Q_{GE}	Gate-Emitter Charge	$V_{GE}=15V$	---	16	---	nC	
Q_{GC}	Gate-Collector Charge	$I_C=25A$	---	90	---	nC	
$t_{d(on)}$	Turn-on Delay Time	$V_{CC}=600V$ $V_{GE}=\pm 15V$ $I_C=25A$ $R_G=20\Omega$ Inductive Load $T_C=25^\circ\text{C}$	---	34	---	ns	
t_r	Turn-on Rise Time		---	42	---	ns	
$t_{d(off)}$	Turn-off Delay Time		---	229	---	ns	
t_f	Turn-off Fall Time		---	242	---	ns	
E_{on}	Turn-on Switching Loss		---	3.00	---	mJ	
E_{off}	Turn-off Switching Loss		---	1.99	---	mJ	
E_{ts}	Total Switching Loss		---	4.99	---	mJ	
$t_{d(on)}$	Turn-on Delay Time		$V_{CC}=600V$ $V_{GE}=\pm 15V$ $I_C=25A$ $R_G=20\Omega$ Inductive Load $T_C=150^\circ\text{C}$	---	31	---	ns
t_r	Turn-on Rise Time			---	53	---	ns
$t_{d(off)}$	Turn-off Delay Time	---		296	---	ns	
t_f	Turn-off Fall Time	---		398	---	ns	
E_{on}	Turn-on Switching Loss	---		3.46	---	mJ	
E_{off}	Turn-off Switching Loss	---		2.85	---	mJ	
E_{ts}	Total Switching Loss	---		6.31	---	mJ	
C_{ies}	Input Capacitance	$V_{CE}=25V$		---	1468	---	pF
C_{oes}	Output Capacitance	$V_{GE}=0V$		---	162	---	pF
C_{res}	Reverse Transfer Capacitance	$f=1\text{MHz}$	---	82	---	pF	

Diode Characteristics ($T_C=25^{\circ}C$ unless otherwise noted)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	$I_F=25A$	---	2.0	2.35	V
t_{rr}	Diode Reverse Recovery Time	$V_{CE}=600V$	---	207	---	ns
I_{rr}	Diode Peak Reverse Recovery Current	$I_F=25A$ $di_F/dt=500A/us$	---	15.6	---	A
Q_{rr}	Diode Reverse Recovery Charge	$T_C=25^{\circ}C$	---	1425	---	nC
t_{rr}	Diode Reverse Recovery Time	$V_{CE}=600V$	---	348	---	ns
I_{rr}	Diode Peak Reverse Recovery Current	$I_F=25A$ $di_F/dt=500A/us$	---	31.1	---	A
Q_{rr}	Diode Reverse Recovery Charge	$T_C=150^{\circ}C$	---	5144	---	nC

Note 1: Repetitive rating, pulse width limited by maximum junction temperature

Typical Characteristics

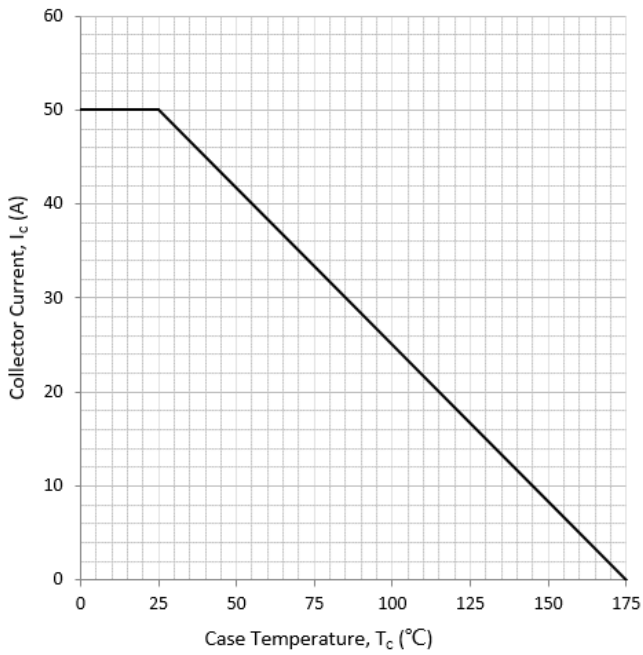


Fig. 1 Maximum DC Collector Current vs. Case Temperature

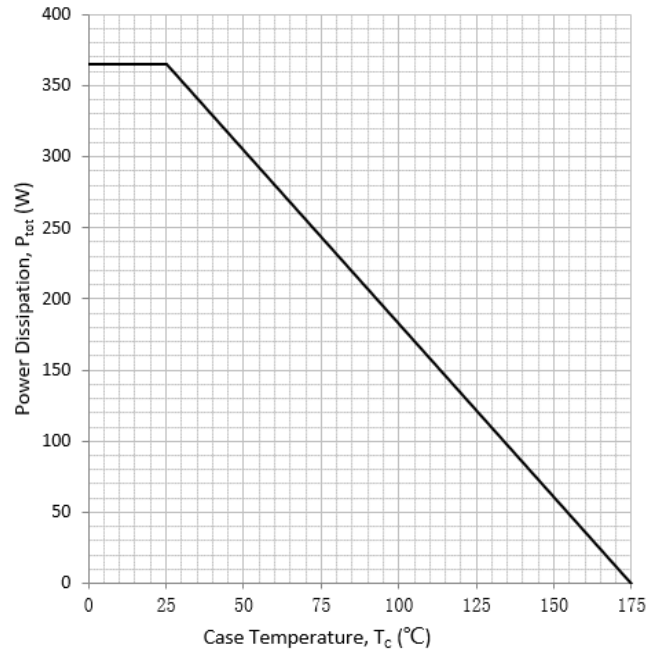


Fig. 2 Power Dissipation vs. Case Temperature

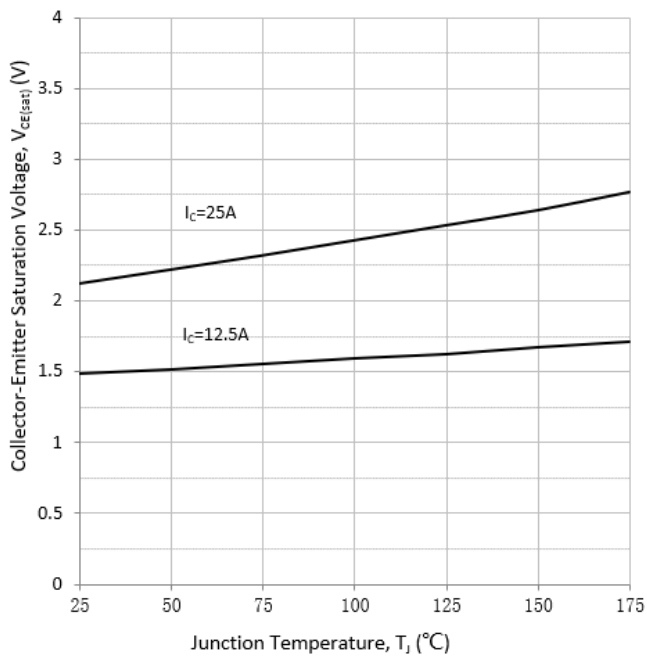


Fig. 3 Typical Collector-Emitter Saturation Voltage vs. Junction Temperature at $V_{GE}=15V$

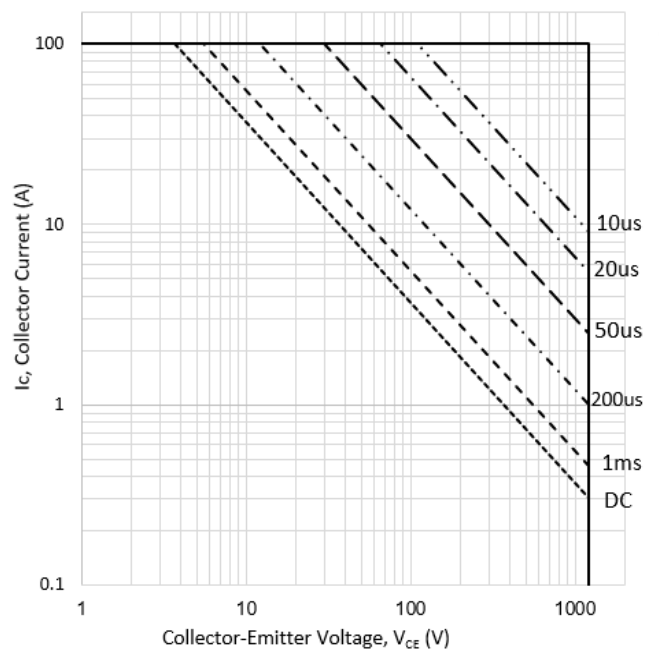


Fig. 4 Safe Operating Area at $T_c=25°C$ and $T_j \leq 175°C$

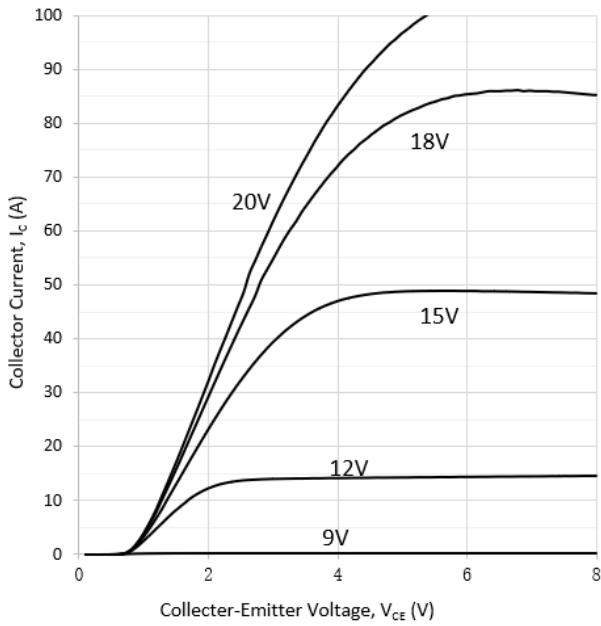


Fig. 5 Typical IGBT Output Characteristics at $T_j=25^\circ\text{C}$

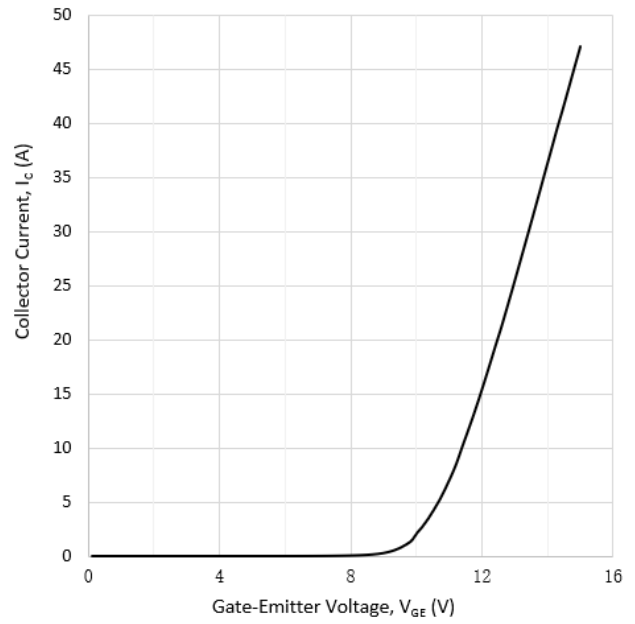


Fig. 6 Typical Transfer Characteristics at $V_{ce}=20V$

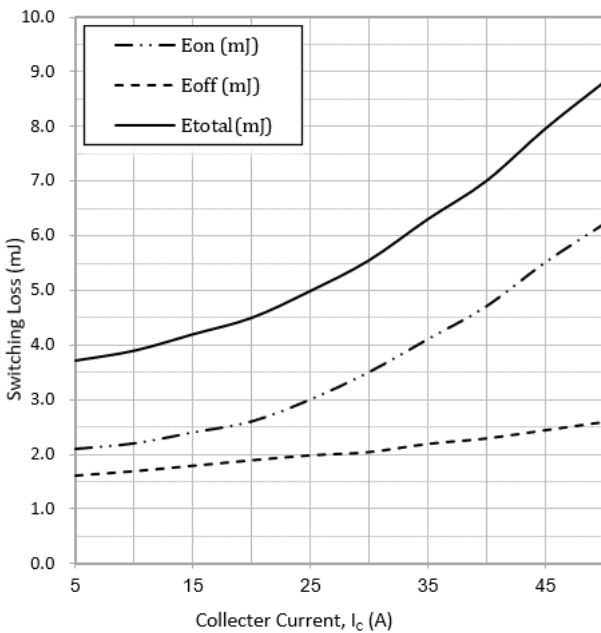


Fig. 7 Typical Energy Loss vs. I_c at $T_c=25^\circ\text{C}$, $V_{ce}=600V$, $V_{ge}=\pm 15V$ and $R_g=20\Omega$

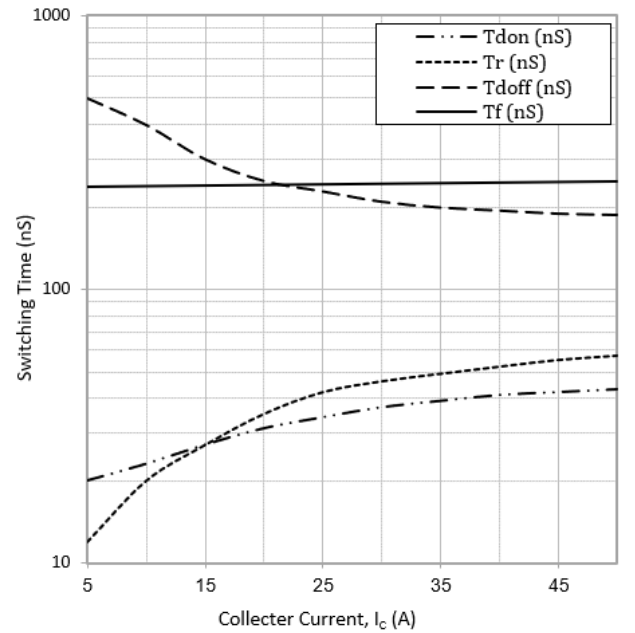


Fig. 8 Typical Switching Time vs. I_c at $T_c=25^\circ\text{C}$, $V_{ce}=600V$, $V_{ge}=\pm 15V$ and $R_g=20\Omega$

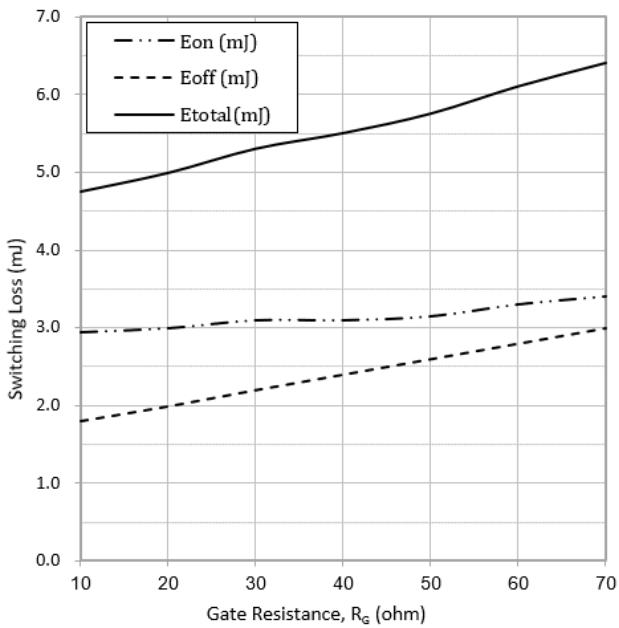


Fig. 9 Typical Energy Loss vs. Rg at $T_C=25^\circ\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=15\text{V}$ and $I_C=25\text{A}$

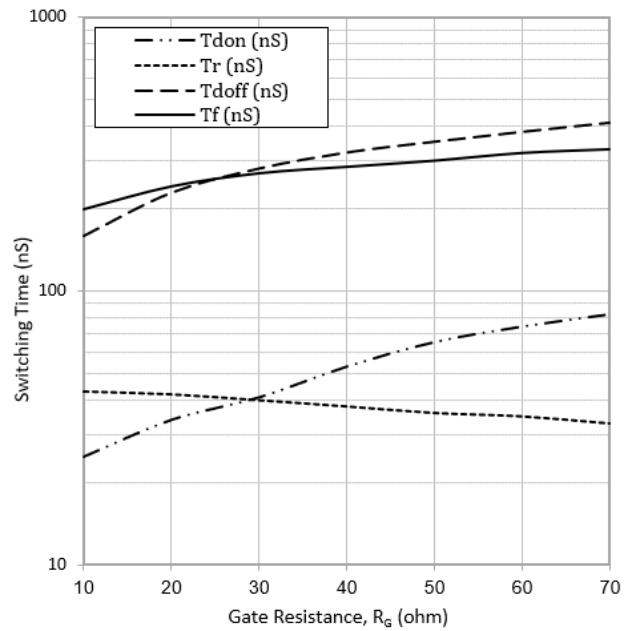


Fig. 10 Typical Switching Time vs. Rg at $T_C=25^\circ\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=15\text{V}$ and $I_C=25\text{A}$

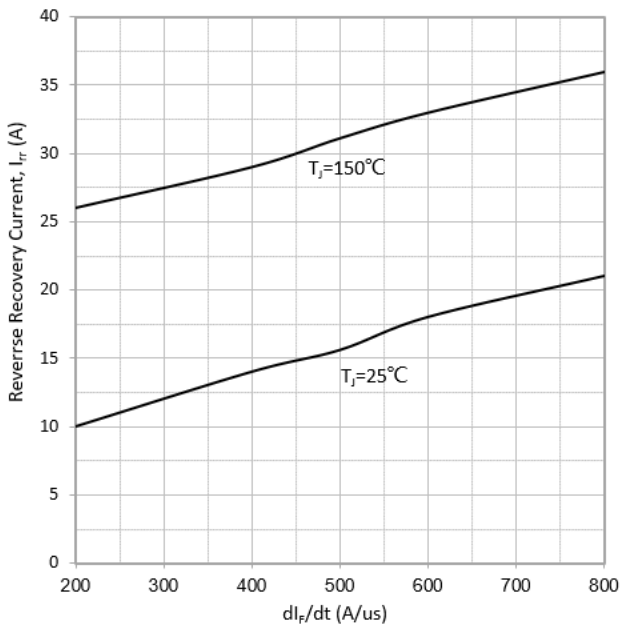


Fig. 11 Typical Diode I_{rr} vs. di_F/dt at $V_{CC}=600\text{V}$ and $V_F=25\text{A}$

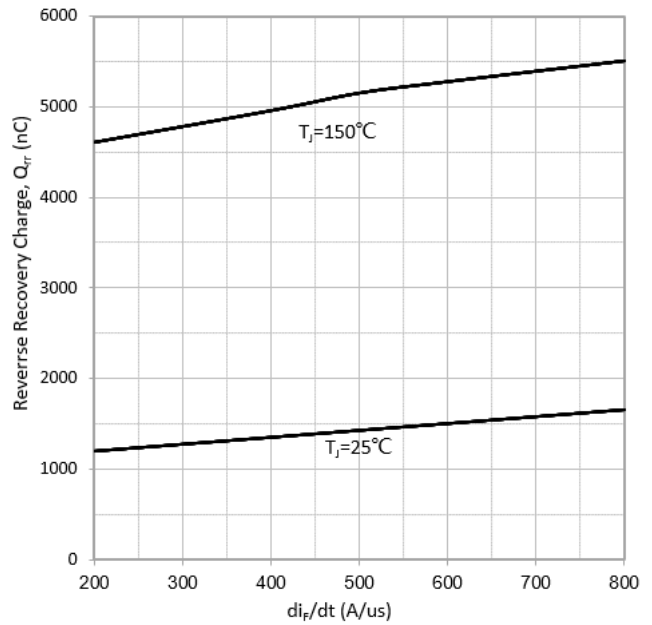


Fig. 12 Typical Diode Q_{rr} vs. di_F/dt at $V_{CC}=600\text{V}$ and $V_F=25\text{A}$

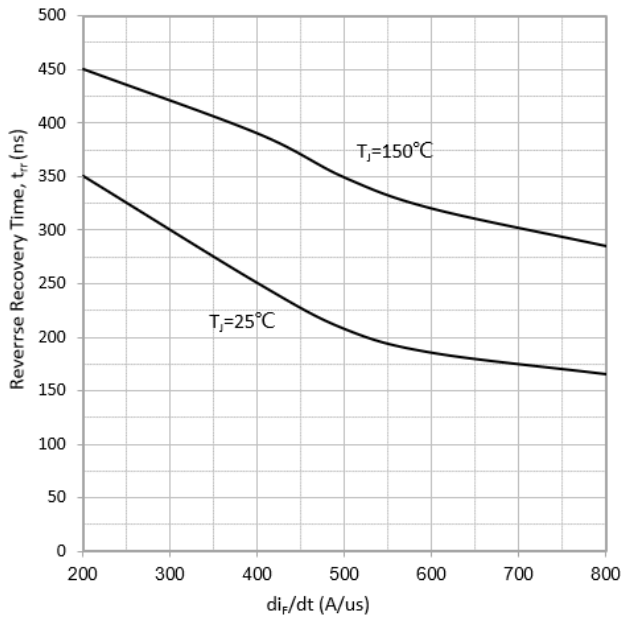


Fig. 13 Typical Diode t_{rr} vs. di_F/dt at $V_{CC}=600V$ and $V_F=25A$

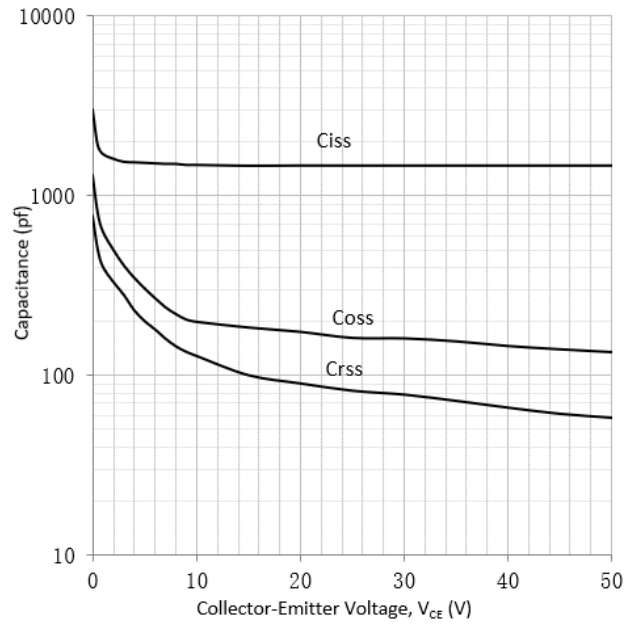


Fig. 14 Typical Capacitance vs. V_{CE} at $V_{GE}=0V$ and $f=1MHz$

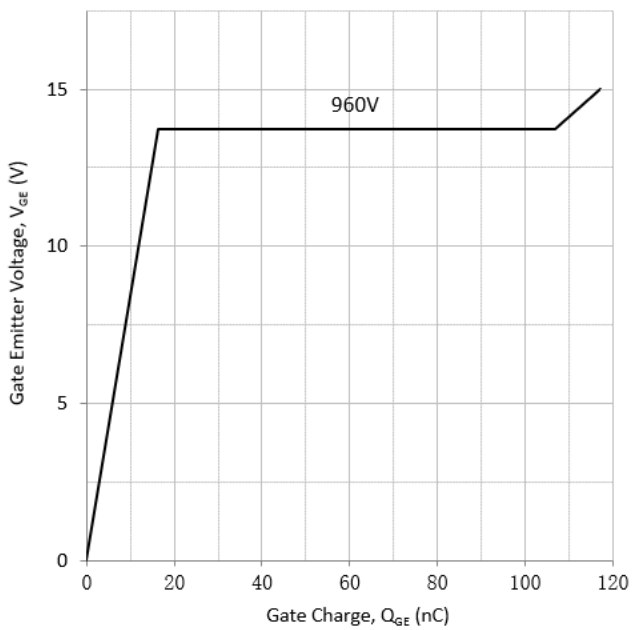


Fig. 15 Typical Gate Charge vs. V_{GE} at $I_C=25A$

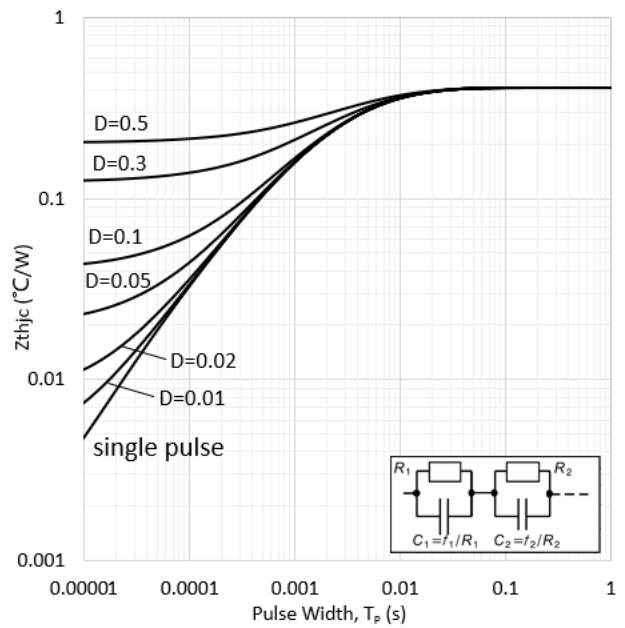
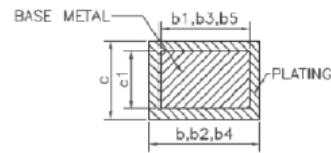
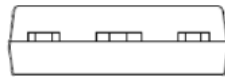
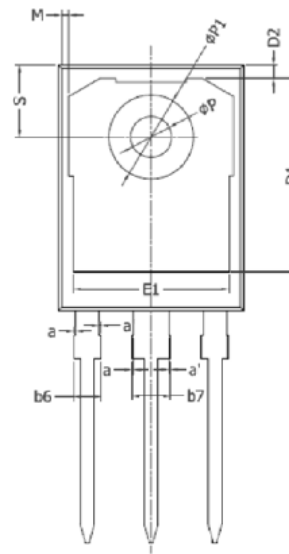
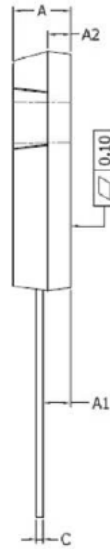
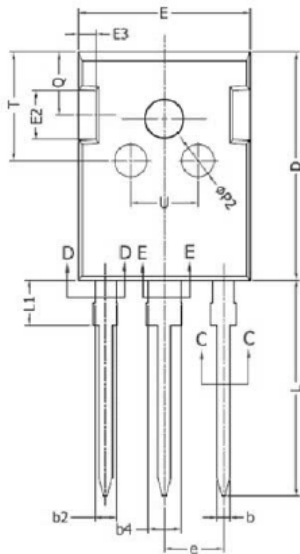


Fig. 16 IGBT Transient Thermal Resistance ($D=t_p/T$)

Package Information

TO-247



SECTION C-C, D-D & E-E

COMMON DIMENSIONS
(UNITS OF MEASURE =MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	4.90	5.00	5.10
A1	2.31	2.41	2.51
A2	1.90	2.00	2.10
a	0	---	0.15
a'	0	---	0.15
b	1.16	---	1.26
b1	1.15	1.2	1.22
b2	1.96	---	2.06
b3	1.95	2.00	2.02
b4	2.96	---	3.06
b5	2.96	3.00	3.02
b6	---	---	2.25
b7	---	---	3.25
c	0.59	---	0.66
c1	0.58	0.60	0.62
D	20.90	21.00	21.10
D1	16.25	16.55	16.85
D2	1.05	1.17	1.35
E	15.70	15.80	15.90
E1	13.10	13.30	13.50
E2	4.40	4.50	4.60
E3	1.50	1.60	1.70
e	5.436 BSC		
L	19.80	19.92	20.10
L1	---	---	4.30
M	0.35	---	0.95
P	3.40	3.50	3.60
P1	7.00	---	7.40
P2	2.40	2.50	2.60
Q	5.60	---	6.00
S	6.05	6.15	6.25
T	9.80	---	10.20
U	6.00	---	6.40

NOTES:

ALL DIMENSIONS REFER TO JEDEC STANDARD TO-247 AND DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.

EJECTION MARK DEPTH $0.10^{+0.15}_{-0.10}$

Revision History

Ver.	Date	Change Notice
1.0	2020/10/15	Released

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[IHW40N65R5XKSA1](#) [IHW20N65R5XKSA1](#) [IGW25T120FKSA1](#) [AOD5B60D](#) [APT15GT60BRDQ1G](#) [APT35GP120J](#) [STGWT60H65FB](#)
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