

< HVIGBT MODULES >

# CM750HG-130R

HIGH POWER SWITCHING USE  
INSULATED TYPE

4th-Version HVIGBT (High Voltage Insulated Gate Bipolar Transistor) Modules

**CM750HG-130R**



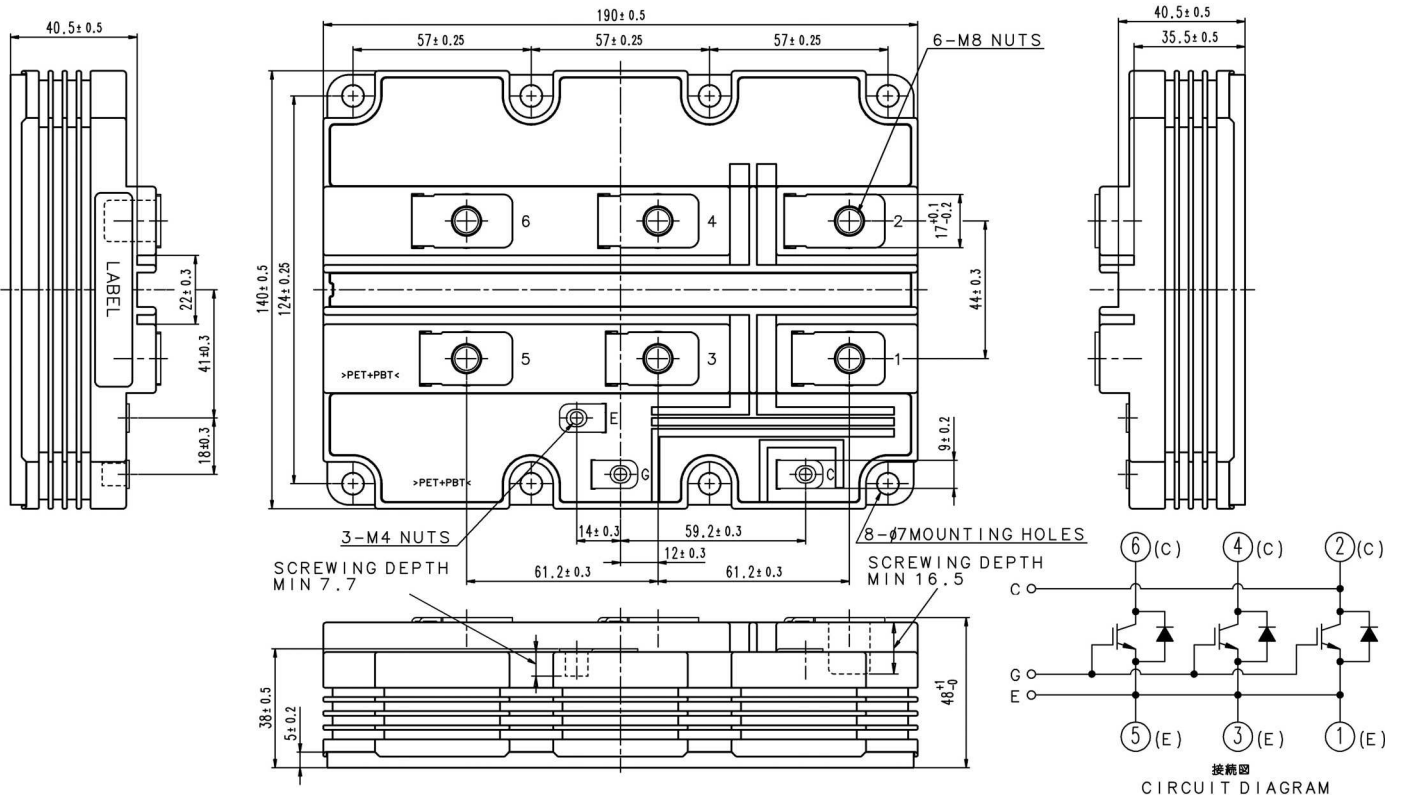
- $I_C$  ..... 750A
- $V_{CES}$  ..... 6500V
- 1-element in a pack
- High Insulated type
- LPT-IGBT / Soft Recovery Diode
- AISiC baseplate

**APPLICATION**

Traction drives, High Reliability Converters / Inverters, DC choppers

**OUTLINE DRAWING & CIRCUIT DIAGRAM**

Dimensions in mm



**MAXIMUM RATINGS**

Symbol	Item	Conditions	Ratings	Unit
$V_{CES}$	Collector-emitter voltage	$V_{GE} = 0V, T_j = +125^{\circ}C$	6500	V
		$V_{GE} = 0V, T_j = +25^{\circ}C$	6300	
		$V_{GE} = 0V, T_j = -50^{\circ}C$	5700	
$V_{GES}$	Gate-emitter voltage	$V_{CE} = 0V, T_j = 25^{\circ}C$	$\pm 20$	V
$I_C$	Collector current	DC, $T_c = 95^{\circ}C$	750	A
$I_{CRM}$		Pulse (Note 1)	1500	A
$I_E$	Emitter current (Note 2)	DC	750	A
$I_{ERM}$		Pulse (Note 1)	1500	A
$P_{tot}$	Maximum power dissipation (Note 3)	$T_c = 25^{\circ}C$ , IGBT part	10400	W
$V_{iso}$	Isolation voltage	RMS, sinusoidal, $f = 60Hz, t = 1 \text{ min.}$	10200	V
$V_e$	Partial discharge extinction voltage	RMS, sinusoidal, $f = 60Hz, Q_{PD} \leq 10 \text{ pC}$	5100	V
$T_j$	Junction temperature		$-50 \sim +150$	$^{\circ}C$
$T_{jop}$	Operating junction temperature		$-50 \sim +125$	$^{\circ}C$
$T_{stg}$	Storage temperature		$-55 \sim +125$	$^{\circ}C$
$t_{psc}$	Short circuit pulse width	$V_{CC} = 4500V, V_{CE} \leq V_{CES}, V_{GE} = 15V, T_j = 125^{\circ}C$	10	$\mu s$

**ELECTRICAL CHARACTERISTICS**

Symbol	Item	Conditions	Limits			Unit	
			Min	Typ	Max		
$I_{CES}$	Collector cutoff current	$V_{CE} = V_{CES}, V_{GE} = 0V$	$T_j = 25^{\circ}C$	—	—	24.0	mA
			$T_j = 125^{\circ}C$	—	24.0	—	
$V_{GE(th)}$	Gate-emitter threshold voltage	$V_{CE} = 10 V, I_C = 120 \text{ mA}, T_j = 25^{\circ}C$	5.8	6.3	6.8	V	
$I_{GES}$	Gate leakage current	$V_{GE} = V_{GES}, V_{CE} = 0V, T_j = 25^{\circ}C$	-0.5	—	0.5	$\mu A$	
$C_{ies}$	Input capacitance	$V_{CE} = 10 V, V_{GE} = 0 V, f = 100 \text{ kHz}$ $T_j = 25^{\circ}C$	—	136.0	—	nF	
$C_{oes}$	Output capacitance		—	8.6	—	nF	
$C_{res}$	Reverse transfer capacitance		—	4.0	—	nF	
$Q_G$	Total gate charge	$V_{CC} = 2800V, I_C = 1200A, V_{GE} = \pm 15V$	—	10.5	—	$\mu C$	
$V_{CESat}$	Collector-emitter saturation voltage	$I_C = 1200 A$ (Note 4) $V_{GE} = 15 V$	$T_j = 25^{\circ}C$	—	3.80	—	V
			$T_j = 125^{\circ}C$	—	4.80	5.60	
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 3600 V$	$T_j = 25^{\circ}C$	—	1.05	—	$\mu s$
			$T_j = 125^{\circ}C$	—	1.00	1.80	
$t_r$	Turn-on rise time	$I_C = 750 A$ $V_{GE} = \pm 15 V$	$T_j = 25^{\circ}C$	—	0.18	—	$\mu s$
			$T_j = 125^{\circ}C$	—	0.20	0.50	
$E_{on(10\%)}$	Turn-on switching energy (Note 5)	$R_{G(on)} = 3.3 \Omega$ $L_s = 150 \text{ nH}$	$T_j = 25^{\circ}C$	—	3.35	—	J
			$T_j = 125^{\circ}C$	—	4.10	—	
$E_{on}$	Turn-on switching energy (Note 6)	Inductive load	$T_j = 25^{\circ}C$	—	3.50	—	J
			$T_j = 125^{\circ}C$	—	4.40	—	
$t_{d(off)}$	Turn-off delay time	$V_{CC} = 3600 V$	$T_j = 25^{\circ}C$	—	7.60	—	$\mu s$
			$T_j = 125^{\circ}C$	—	8.00	9.20	
$t_f$	Turn-off fall time	$I_C = 750 A$ $V_{GE} = \pm 15 V$	$T_j = 25^{\circ}C$	—	0.40	—	$\mu s$
			$T_j = 125^{\circ}C$	—	0.45	1.00	
$E_{off(10\%)}$	Turn-off switching energy (Note 5)	$R_{G(off)} = 33 \Omega$ $L_s = 150 \text{ nH}$	$T_j = 25^{\circ}C$	—	3.10	—	J
			$T_j = 125^{\circ}C$	—	4.60	—	
$E_{off}$	Turn-off switching energy (Note 6)	Inductive load	$T_j = 25^{\circ}C$	—	3.40	—	J
			$T_j = 125^{\circ}C$	—	4.90	—	

**ELECTRICAL CHARACTERISTICS (continuation)**

Symbol	Item	Conditions	Limits			Unit	
			Min	Typ	Max		
$V_{EC}$	Emitter-collector voltage (Note 2)	$I_E = 750 \text{ A}$ (Note 4) $V_{GE} = 0 \text{ V}$	$T_j = 25^\circ\text{C}$	—	3.30	—	V
			$T_j = 125^\circ\text{C}$	—	3.40	4.20	
$t_{rr}$	Reverse recovery time (Note 2)		$T_j = 25^\circ\text{C}$	—	0.65	—	$\mu\text{s}$
			$T_j = 125^\circ\text{C}$	—	0.70	—	
$I_{rr}$	Reverse recovery current (Note 2)	$V_{CC} = 3600 \text{ V}$ $I_C = 750 \text{ A}$	$T_j = 25^\circ\text{C}$	—	800	—	A
			$T_j = 125^\circ\text{C}$	—	900	—	
$Q_{rr}$	Reverse recovery charge (Note 2)	$V_{GE} = \pm 15 \text{ V}$ $R_{G(on)} = 3.3 \Omega$	$T_j = 25^\circ\text{C}$	—	630	—	$\mu\text{C}$
			$T_j = 125^\circ\text{C}$	—	900	—	
$E_{rec(10\%)}$	Reverse recovery energy (Note 2) (Note 5)	$L_s = 150 \text{ nH}$ Inductive load	$T_j = 25^\circ\text{C}$	—	0.90	—	J
			$T_j = 125^\circ\text{C}$	—	1.70	—	
$E_{rec}$	Reverse recovery energy (Note 2) (Note 6)		$T_j = 25^\circ\text{C}$	—	1.00	—	J
			$T_j = 125^\circ\text{C}$	—	1.80	—	

**THERMAL CHARACTERISTICS**

Symbol	Item	Conditions	Limits			Unit
			Min	Typ	Max	
$R_{th(j-c)Q}$	Thermal resistance	Junction to Case, IGBT part	—	—	12.0	K/kW
$R_{th(j-c)D}$		Junction to Case, FWDi part	—	—	22.0	K/kW
$R_{th(c-s)}$	Contact thermal resistance	Case to heat sink, $\lambda_{grease} = 1\text{W/m}^2\text{K}$ , $D_{(c-s)} = 100\mu\text{m}$	—	6.0	—	K/kW

**MECHANICAL CHARACTERISTICS**

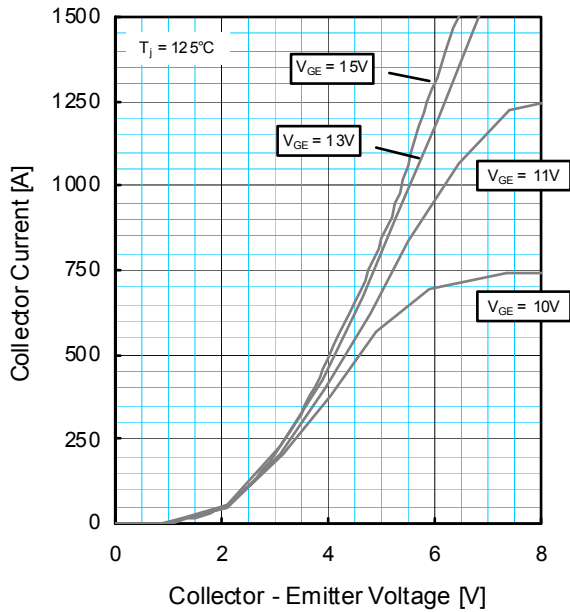
Symbol	Item	Conditions	Limits			Unit
			Min	Typ	Max	
$M_t$	Mounting torque	M8 : Main terminals screw	7.0	—	22.0	N·m
$M_s$		M6 : Mounting screw	3.0	—	6.0	N·m
$M_t$		M4 : Auxiliary terminals screw	1.0	—	3.0	N·m
$m$	Mass		—	1.4	—	kg
CTI	Comparative tracking index		600	—	—	—
$d_a$	Clearance		26.0	—	—	mm
$d_s$	Creepage distance		56.0	—	—	mm
$L_{PCE}$	Parasitic stray inductance		—	15.0	—	nH
$R_{CC+EE}$	Internal lead resistance	$T_C = 25^\circ\text{C}$	—	0.18	—	m $\Omega$
$r_g$	Internal gate resistance	$T_C = 25^\circ\text{C}$	—	2.6	—	$\Omega$

Note1. Pulse width and repetition rate should be such that junction temperature ( $T_j$ ) does not exceed  $T_{jopmax}$  rating.

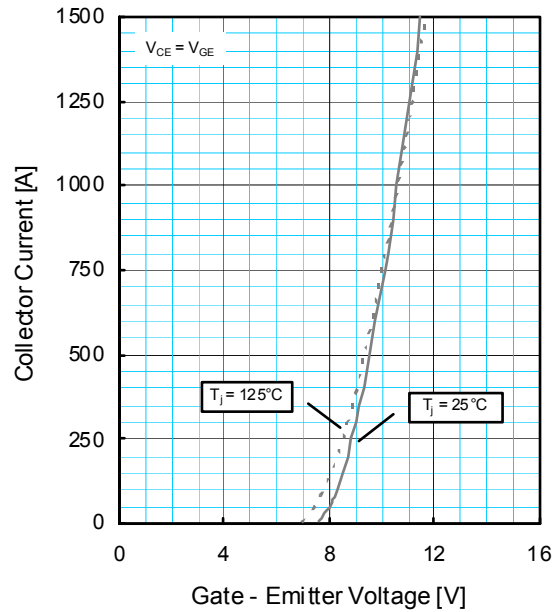
- The symbols represent characteristics of the anti-parallel, emitter to collector free-wheel diode (FWD).
- Junction temperature ( $T_j$ ) should not exceed  $T_{jmax}$  rating ( $150^\circ\text{C}$ ).
- Pulse width and repetition rate should be such as to cause negligible temperature rise.
- $E_{on(10\%)}$  /  $E_{off(10\%)}$  /  $E_{rec(10\%)}$  are the integral of  $0.1V_{CE} \times 0.1I_C \times dt$ .
- Definition of all items is according to IEC 60747, unless otherwise specified.

PERFORMANCE CURVES

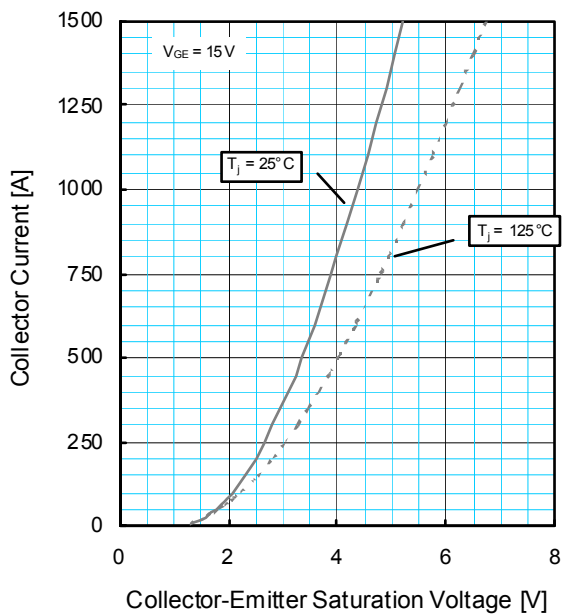
**OUTPUT CHARACTERISTICS (TYPICAL)**



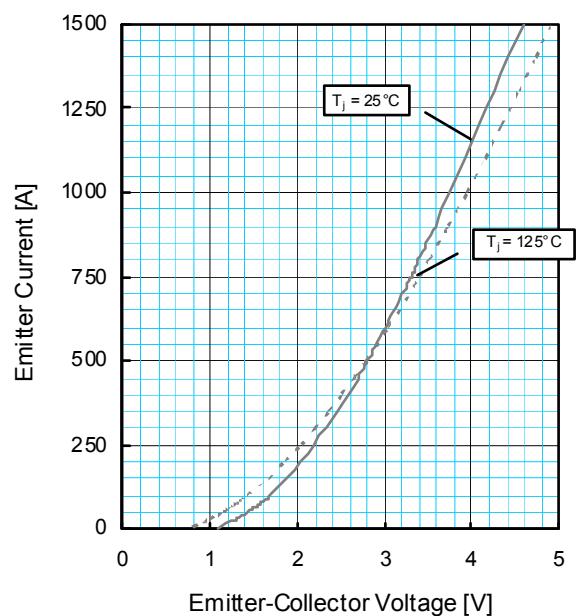
**TRANSFER CHARACTERISTICS (TYPICAL)**



**COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)**

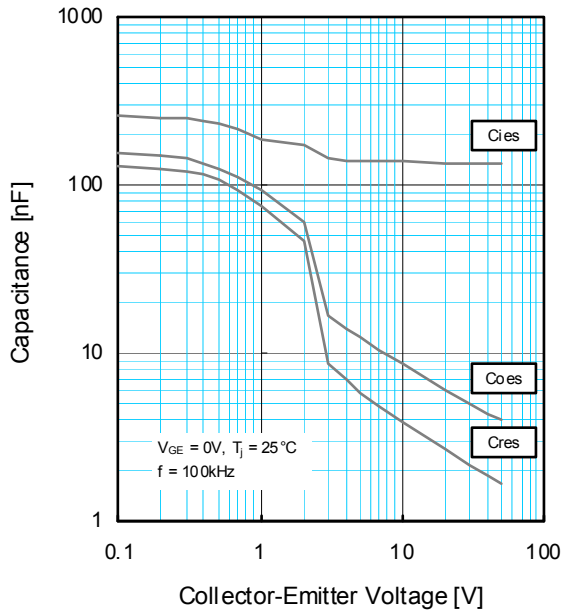


**FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)**

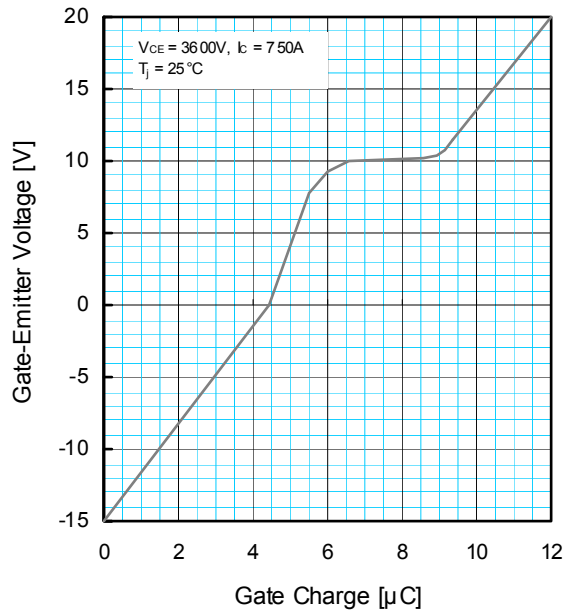


PERFORMANCE CURVES

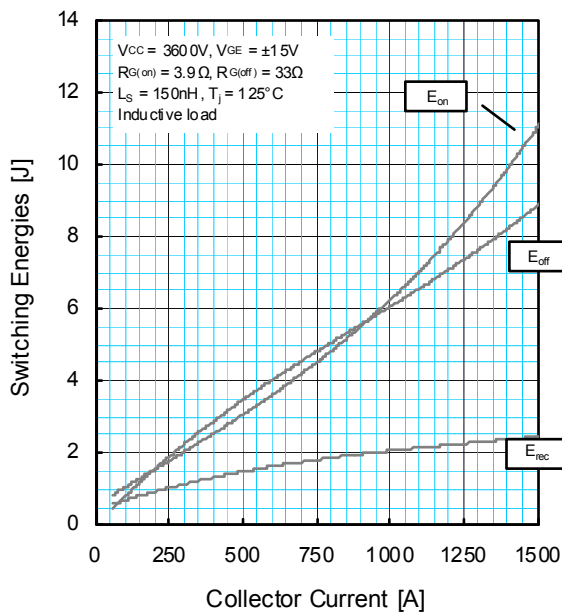
**CAPACITANCE CHARACTERISTICS (TYPICAL)**



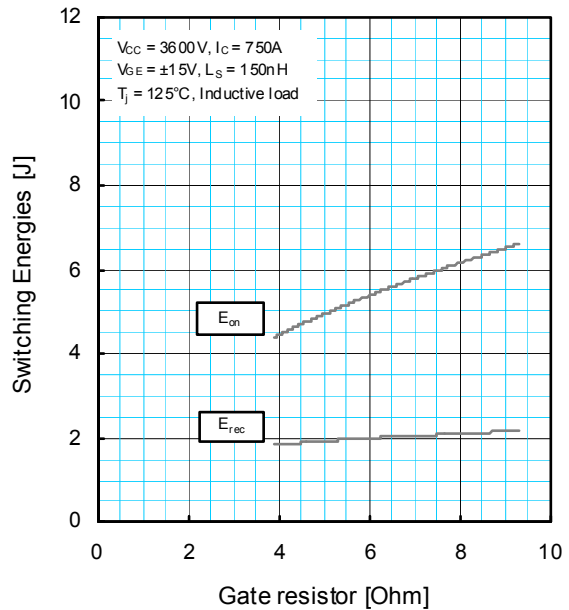
**GATE CHARGE CHARACTERISTICS (TYPICAL)**



**HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)**

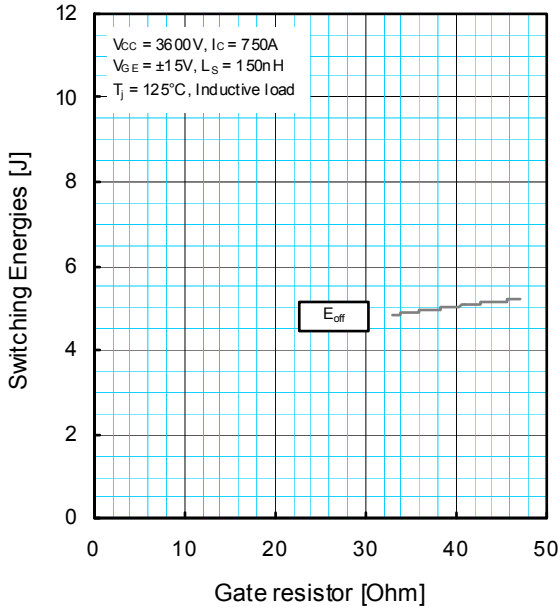


**HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)**

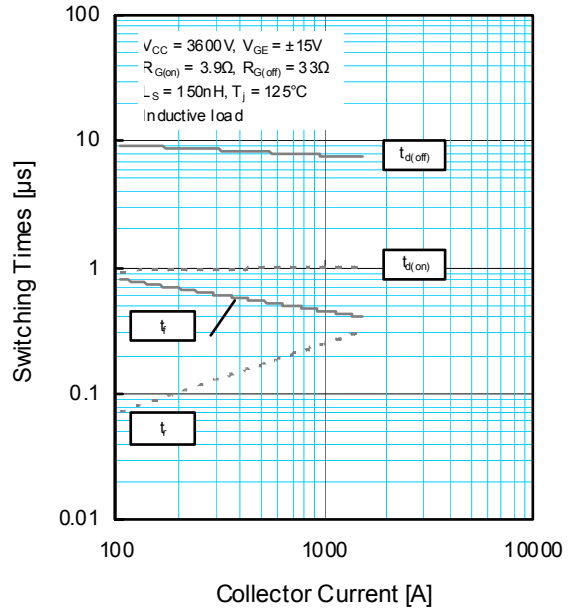


PERFORMANCE CURVES

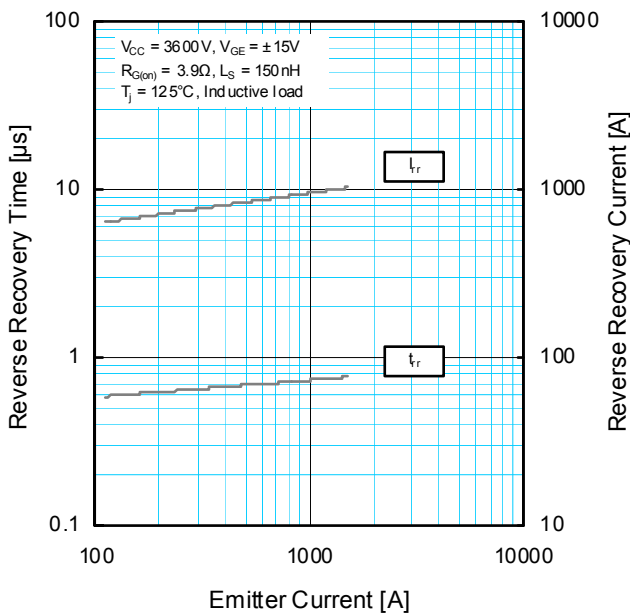
**SWITCHING ENERGY CHARACTERISTICS (TYPICAL)**



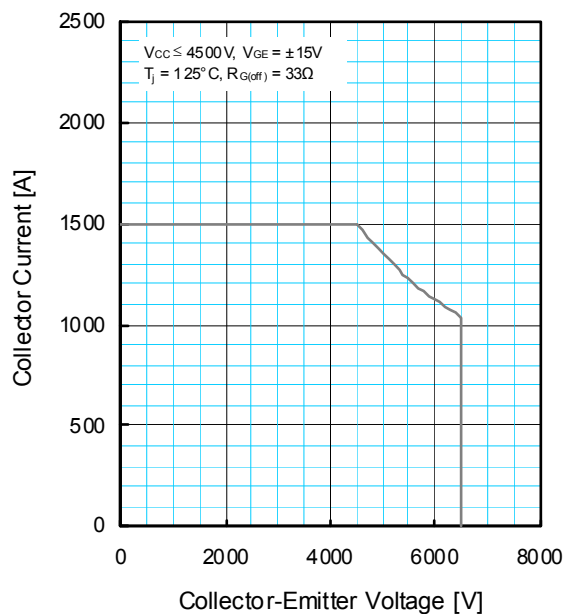
**HALF-BRIDGE SWITCHING TIME CHARACTERISTICS (TYPICAL) HALF-BRIDGE**



**FREE-WHEEL DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)**

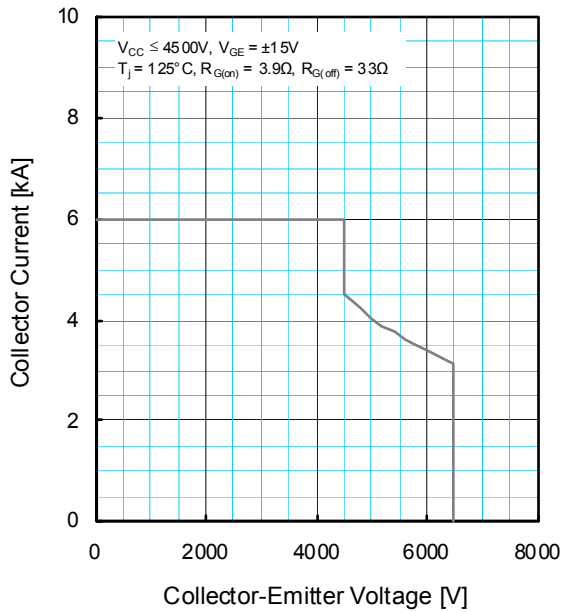


**REVERSE BIAS SAFE OPERATING AREA (RBSOA)**

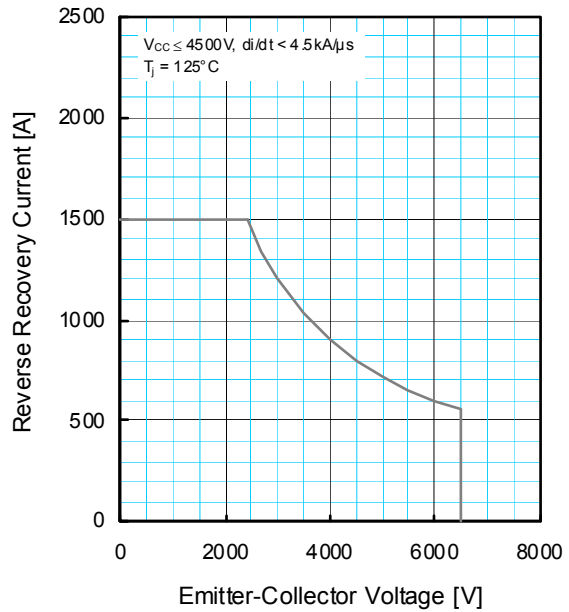


PERFORMANCE CURVES

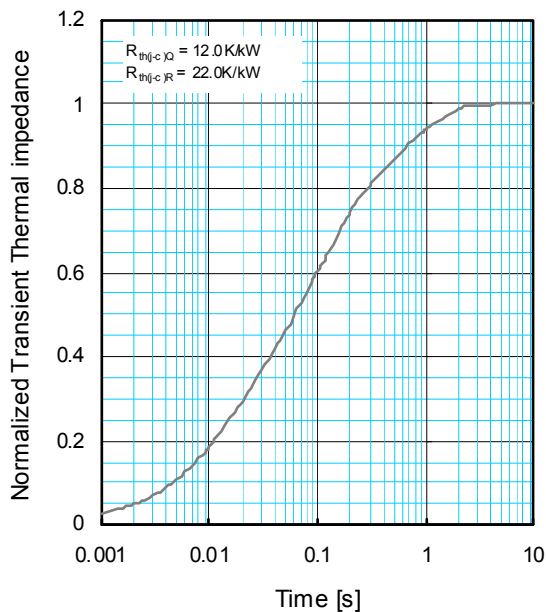
**SHORT CIRCUIT  
SAFE OPERATING AREA (SCSOA)**



**FREE-WHEEL DIODE REVERSE RECOVERY  
SAFE OPERATING AREA (RRSOA)**



**TRANSIENT THERMAL IMPEDANCE  
CHARACTERISTICS**



$$Z_{th(j-c)}(t) = \sum_{i=1}^n R_i \left\{ 1 - \exp\left(-\frac{t}{\tau_i}\right) \right\}$$

	1	2	3	4
$R_i$ [K/kW] :	0.0055	0.2360	0.4680	0.2905
$\tau_i$ [sec] :	0.0001	0.0131	0.0878	0.6247

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